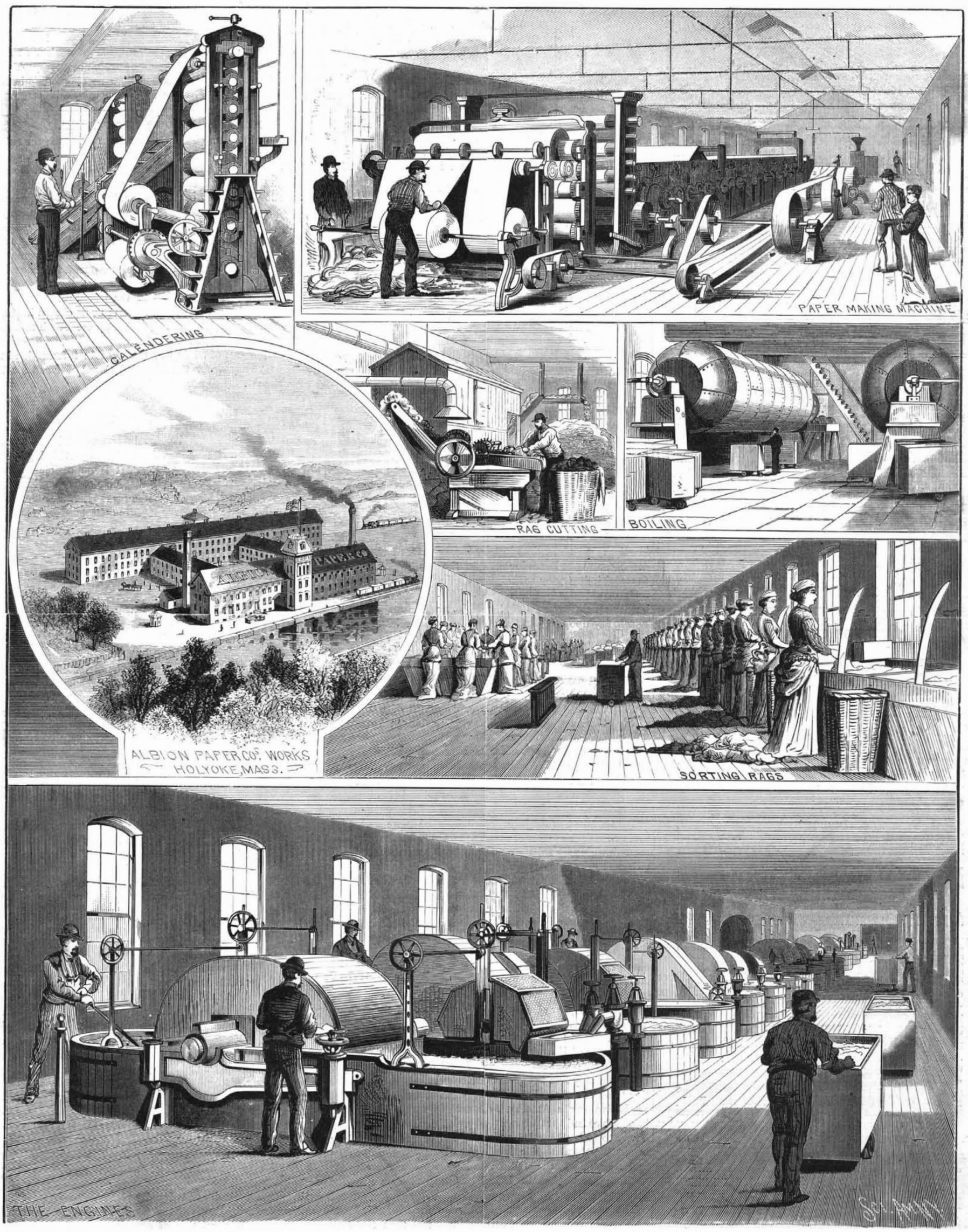
SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY AND MANUFACTURES.

Vol. XLII.—No. 14. [NEW SERIES.] NEW YORK, APRIL 3, 1880. [$3.20 per Annum. [POSTAGE PREPAID.]



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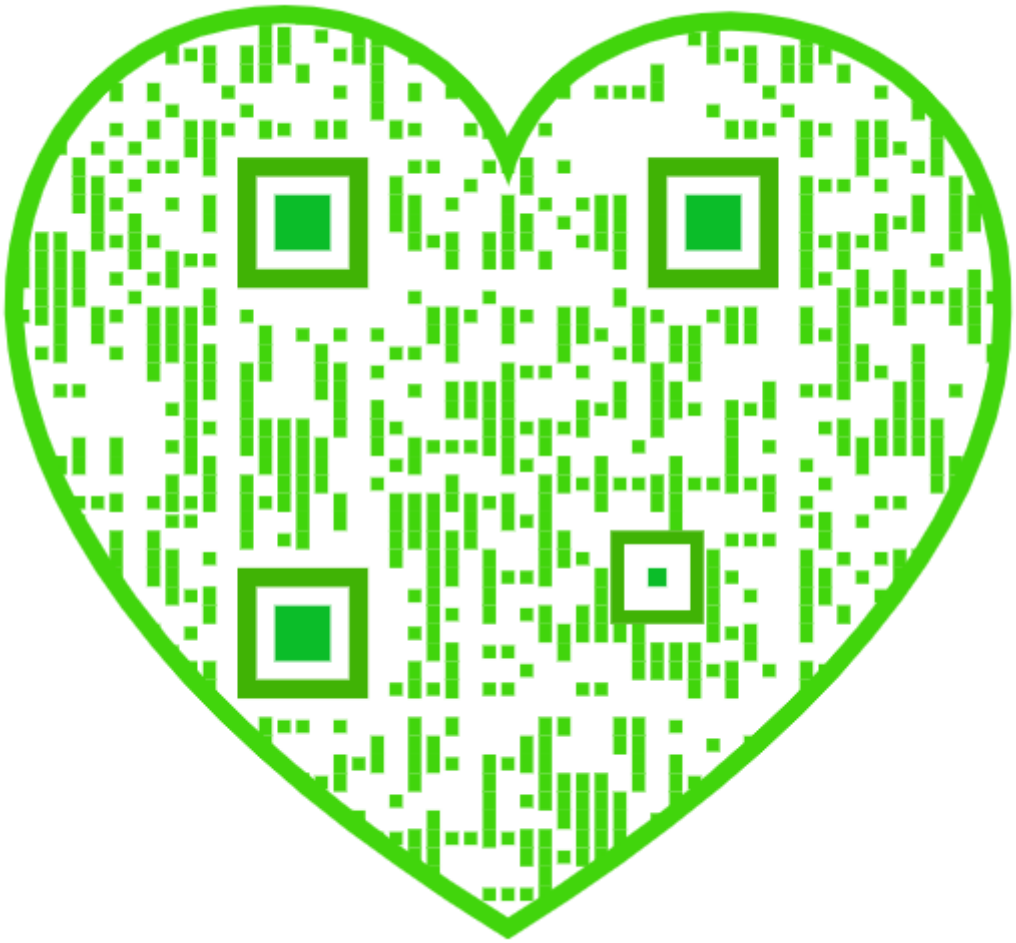

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH.

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NEW YORK, SATURDAY, APRIL 3, 1880.

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AMERICA'S INDUSTRIAL SUPREMACY ASSURED.

"Every war, even a victorious war, is a national calamity." So writes the Count Von Moltke, Germany's most successful warrior. And he might have added To be constantly preparing for war is a national calamity but little inferior to actual warfare. Last year Europe expended for military and naval purposes something near $800,000,000, and did no fighting. This great burden was borne chiefly by eight powers, as follows: Russia, $173,740,000; Great Britain, $153,510,000; France, $128,520,000; Germany, $101,626,000; Austro-Hungary, $53,074,000; Italy, $44,030,000; Spain, $28,560,000; Turkey, $23,800,000.

This profitless squandering of money—which the overtaxed producers have to furnish—is unfortunately not the whole of the blood tax upon Europe in times of peace. The national debts of Europe, due almost entirely to past wars and preparations for future conflicts, amount to more than twenty billion dollars, the interest of which the producers have to meet. About eighteen billions of debt stand against the eight powers above named.

This is the tax paid in money. That which comes from withdrawing able-bodied men from productive labor is an item of scarcely less magnitude, for the standing armies of Europe foot up something over eight millions. In a late report by the Hungarian ministry, designed to show the relative weakness of the Austro-Hungarian forces, the armies of the five chief States of Europe were enumerated as follows:

The military strength of Russia consists of 3,046,800 men, of whom 600,000 belong to the reserve and 2,446,800 to the standing army. The regular army of France comprises 1,689,000 soldiers of all arms, the territorial army, 1,208,000 total, 2,289,000; to be increased in 1892 by the addition of 300,000 reserve men to 2,723,000. The German power of all classes is represented by 2,004,300 men, of whom 1,076,200 belong to the standing army, 307,200 to the landwehr, and 620,900 to the reserve. Italy has an army of 698,000 and a militia of 310,000. In 1892, when the reserve will number 1,016,200, her total strength will reach 2,024,200. Austro-Hungary possesses a standing army of 800,000, a landwehr of 299,318, and a reserve of 95,000 men; total, 1,194,318. The grand total of all these forces amounts to 16,471,918, the standing armies alone numbering 7,925,000. To these figures there should be added for the armies of Great Britain, Spain, and Turkey, about 700,000 regular soldiers and twice as many reserves. Allowing that half of the men nominally in the European armies are at home on furlough, and able to take part in productive labor, there cannot be less than 4,000,000 men in the prime of life permanently withdrawn from productive industry in the great states named. Counting the labor of these men as worth no more than a hundred dollars each a year, the burden of their idleness can be measured only by hundreds of millions of dollars annually. Adding the value of the time lost by the millions of reserves in drilling, and the losses incident to the spoiling of men for peaceful industry by enforced soldiering during the years of early manhood, a rough idea can be formed of the aggregate burden which governmental ambition and mutual fear combine to lay upon the shoulders of Europe's working population.

Not the least disheartening feature of this state of things is its tendency to grow steadily worse. As a leading English journal pertinently remarks, it is the special aggravation of this waste of human energies that it is interminable, that it settles nothing finally, that the consequence of war is not peace, but a condition of further preparation, in which victory and defeat alike are used as arguments for further preparations. Germany is victor, and becomes a camp; France is vanquished, and becomes a parade ground. Germany is united and must therefore be drilled; Italy is united and must therefore be drilled; the Balkan peninsula is disunited and must therefore be drilled. Whatever the circumstances or the sacrifices or the hopes there must be more and ever more men drilled, more expenditure on preparations for war, more devotion by rulers to military work, more surrender of citizens to disciplinary training.

To this frightful extent Europe is handicapped in the race for industrial supremacy. It is the penalty which the people have to pay for the accidents of their geographical position, the forms of government they have inherited, and their worse inheritance of military history, national hatreds, and political entanglements. At the same time the ability of the European workers to meet these heavy obligations is being steadily lessened, not only by the drafting of their best brawn and bone into the armies, but by the voluntary expatriation every year of thousands of their more energetic sons and daughters.

The United States comprise about the same area as the great states of Europe combined, and already have nearly one-fifth as many inhabitants. In all probability children now born may live to see United America equal in population to all Europe. From our continental position any great aggressive war in America by American men is altogether impossible, and the prospect of great civil wars is, we are happy to believe, not less remote. Our strength is rapidly becoming so great—if it is not already so—that no foreign nations are likely to assail us; and the aversion of our people to foreign entanglements is likely to keep us from offensive foreign wars.

The natural advantages of America for diversified and prosperous industries are certainly not less than those enjoyed by Europe; and our people are quite as capable as those of Europe of making the most of their industrial opportunities. The problem of industrial supremacy is, therefore, not hard to solve. The single advantage we enjoy in being free from the terrible war-bardens of Europe even in times of peace, and our practical exemption from risk of foreign wars, cannot fail to maintain us in our position as the most prosperous people in the world. The annual tale of labor prevented, labor misapplied, and labor driven away by the enormous armies and armaments of Europe finds no counterpart here. All our labor is productive, all tends to swell our national wealth, and to increase our power to do and to enjoy. This alone would insure our industrial supremacy, other things being equal, in a very few years; and fortunately our freedom from Europe's military burdens is but one of the great blessings we have to be thankful for—but one of the conditions which go to make sure our superiority in productive power—our supremacy in the arts of peace. And the advantage of all this must and does accrue mainly to the American producer, showing itself in lighter taxes, higher wages, a greater diffusion of wealth, and a more generous style of living; all of which are everywhere recognizable by European tourists here as characteristic of the lives of American workers.

PROTECTION FROM YELLOW FEVER.

"Out of sight, out of mind," has been too much the rule in regard to this matter. Two successive years of severe visitation of this dreadful disease at New Orleans and Memphis each time drew general attention to the necessity for some action in the way of prevention, but with its disappearance the matter appears to have passed almost completely out of the public mind. Doctors are by no means agreed as to the best method for its treatment, nor as to its original cause, and just how it is propagated, other than by contact with the developed disease or its germs, our knowledge is very limited. The fact that stands out most prominently in connection with the subject is that the island of Cuba, and particularly the city of Havana, seem to be its chosen home, and in the latter city the disease has been present each month in the year for every year since 1850.

For the purpose of adding to our specific information in regard to yellow fever the National Board of Health last year sent a special commission to Cuba, whose preliminary report has just been published. What they have furnished does not throw much light on the pathology of the disease, but the facts they present as to the sanitary condition of the island are such as should compel our authorities to erect more effectual barricades than have yet been provided against this pest-house at our very doors. It is impossible to say when the disease first occurred there, but it was first known as an epidemic in Havana in 1761 and 1762, and from that time to this that city has been its principal headquarters, it being generally epidemic there from June to October. The poison is always present, the climatic conditions favor its development, the government takes no practical measures to eradicate it, and the sanitary state of a large portion of the city, as described by the commissioners, is bad almost beyond belief. Many of our citizens go to Havana every year, but it is only a small section of the city that foreigners ever visit, and none will be more surprised than those who have been there at what is said in the report of the actual condition of the greater part of the city.

The water is very impure, and so insufficient in quantity that "a large portion of the population purchase their water daily in kegs and carboys from street venders." The streets are not paved, except in about one-fourth of the city; many of them are so narrow as to afford room for but one vehicle, and in but few cases have any sewers, while the most of these are so filled with solid materials as to be inoperative. Nine-tenths of the houses are only one story high, many of them having the sleeping rooms adjoining the kitchen, privy, and sometimes a stable. Most of the floors are of brick or stone, on a level with or below the streets. "The privy is almost a part of the kitchen; it consists of an excavation, which often extends several feet under the flags of the court; it is never emptied until it will hold no more, which seemed generally to be from five to ten years; it has no ventilating pipe, and belches forth its nauseous odors at times even to the front door . . . In the summer season a fæcal or urinary odor prevails generally, and is distinctly perceptible as it oozes from the doors and windows of almost every house." Notwithstanding that the houses are so mean, rents are very high, as are all to the expenses of living. The government is greatly in debt, its credit is poor, and the taxation very oppressive. On this account any material improvement in the sewage system is hardly to be looked forward to, it being estimated that to make this effective, provide a proper water supply, etc., "to correct some few of the most glaring insanitary evils," would cost $20,000,000. There are many other places in the world that are no cleaner than Havana, and where the temperature is as high or higher, but where the yellow fever never comes, as Canton and Bombay, for instance, and one of the suggestions made in the report is that possibly the alkalinity of the air of Havana has much to do with the prevalence of the disease. The atmosphere of the city is constantly alkaline, but this condition is especially marked during the summer months, and the times of high atmospheric alkalinity coincide with the greatest intensity of yellow fever.

Under these conditions it is quite plain that any protection we have from constant visits of this disease must come from a more stringent regulation of our commercial intercourse with Cuba, as substantially the same circumstances exist in most other Cuban ports as at Havana, though in a lesser de-

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gree. Our government endeavored to do something in this direction by the law of June 2, 1879, which provided that our consuls in foreign ports should see that every vessel bound for the United States should comply with the rules and regulations necessary "to secure the best sanitary condition of the vessel, cargo, passengers, and crew," and prohibiting the entry here of any vessel not provided wtih a prescribed "certificate required to be obtained at the port of departure." In Cuba this law was denounced and its enforcement rendered impracticable, so that it has remained a dead letter. It is evident, therefore, that something further should be done in the way of enforcing a more stringent supervision than is at present exercised on vessels leaving Cuba for the United States, for, with our present exposure we are constantly running the risk of a pestilence which may, in some particularly trying year, be brought thence to our Atlantic cities. Our commercial intercourse with Cuba, important as it may be deemed, should not be considered of sufficient moment to justify our taking any further risks of this kind.

CHEAP PATENTS CHEAPEN GOODS.

The attorneys of anti-patent associations waste no end of rhetoric in describing the burdens put upon purchasers by the multiplication of patent rights. Everything is patented or made with patented machinery or by patented processes; therefore everything must cost a great deal more than it would were there no patents. This is their logic stripped of verbiage. The only fault with it is the persistence of facts in always going dead to the contrary. It is plausible, but it is not true. The moment one sees the word "patented" stamped on an article it is safe to infer one of two things: either the thing is cheaper and better than anything of the sort previously in market, or it is an entirely novel article, which in all probability would never have been produced except for the patent laws.

A pretty illustration of this industrial and commercial paradox occurs in a paper lately read by a prominent English builder before the Manchester (England) Scientific and Mechanical Society. The reader had been, for the second time, comparing English with American made builders' hardware, showing the "marked superiority" of the latter, and was summing up the causes which had led to the competition upon their own doorsteps from American manufacturers. He said:

"Another and most important factor in the sum of deadweight under which we have to stagger in this race is our absurd patent laws. If our legislators had set out with the intention of suppressing the inventive genius of the country, they could not have succeeded more completely than they have done. Can we wonder that America is such a close competitor in the manufacture of these small articles, when we know that for a payment of £18 the inventor can secure himself for seventeen years, whilst in this country it will cost at least twice the money to secure an invention for three years only? How can a man with inventive skill, but with limited means, make the most of his talents? Too often he spends all his little savings, ruins himself, and, when his three years have expired, sees some other person take his invention in hand and realize the profit that belongs to himself. The result is that, disheartened and disgusted, he for ever after buries his talent in the earth. I show you here a small article of American make, not connected with the building trade, as an illustration of the different influence of the patent laws of the two countries. This little machine (an apple parer) carries eight patents, yet its wholesale price in England to-day is less than 4s."

A most ingenious paradox, truly!

The apple-parer was beyond English competition because it carried eight patents. It is safe to say that every single patent had improved its working or lessened its price.

But why could not the English manufacturer, having no patent royalties to pay, produce and sell the article on the spot cheaper than the American, with 3,000 miles of freightage to pay in addition to the cost of manufacture? There may be several reasons more or less sufficient; but one is enough. Having no monopoly of the manufacture, the Englishman could not afford to risk the investment necessary to enable him to produce the article cheaply.

Our Canadian friends discovered that law of trade when they undertook to reap the benefit of Yankee inventions without payment of patent royalties. The only drawback was the simple circumstance that, though Canadians had the world's best inventions to choose from gratis, no man dared to undertake the manufacture of novel articles when everybody else was free to set up in opposition. Canadian industries would not multiply until the Canadian Government recognized the property rights of all inventors; then the Canadians began to be a manufacturing people.

Our Western and Southern citizens are rapidly learning the same important lesson. Industries increase and multiply, and industrial products improve and cheapen in direct proportion to the number of patents issued; and the number of patents issued depends very largely upon the lowness of the official fees for issuing them. Which brings us round to our thesis, that cheapening patents cheapens products.

American Manufacturing Industries.

There are few qualities in one's nature more objectionable perhaps, than egotism, but it is difficult to withhold from others the pardonable pride we feel in referring to the superior engravings which our artists produce each week for this paper.

We allude, especially, to the series of full page engravings, illustrative of the most prominent American industries. The present issue, containing the article on book paper making, is the thirty-seventh of the industrial series which have already appeared in these columns. The views of the several manufacturing establishments we have illustrated were sketched by our own skilled artists on the premises, and for accuracy and artistic grouping of the interior views, showing the various processes of manufacture, we believe there has been nothing attempted before in journalism that has met with the same gratifying success which has been accorded to this interesting feature of this paper.

A continuation of this industrial series we purpose to continue until every important industry of the country has been illustrated and described, and we would thank our readers to suggest what extensive works in their vicinity would furnish interesting material for publication.

NEW YORK ACADEMY OF SCIENCES.

A meeting of the New York Academy of Sciences was held Monday, March 15, at 8 P.M., President Newberry in the chair.

Mr. Kunz exhibited a necklace made of beautiful iridescent shells, and also several handsome pearls from fresh water mussels found near Portland, Maine. Mr. McCarty exhibited several minerals.

The Recording Secretary, Prof. Leeds, read a letter from Norman Lockyer, in which the latter expressed his thanks to the Academy for his election as an honorary member.

THE COAL AND IRON RESOURCES OF VIRGINIA.

The paper announced for the evening was on the coal and iron resources of Virginia, by Prof. Thomas Egleston. The following is a brief synopsis of it:

When Alsace was separated from Lorraine the commissioners drew the boundary in such a manner as to give to Germany all the iron lands and leave nothing of value to France. In like manner the division of Virginia left all the iron in the old State and gave the new one all the coal. These are not, however, the only mineral resources of Virginia. Gold, small quantities of silver, lead, and zinc are also found. Near Wythevill, particularly, the zinc ore rivals that of Friedensville near Bethlehem, Pennsylvania. It appears to be very free from lead, and the zinc made from it has been commanding more than double the price of the common metal in the market.

The great iron region of Virginia lies between the Alleghanies on the west and the Blue Ridge on the east. The space thus inclosed consists of a number of shorter ranges, abounding in limonite, hæmatite, specular iron, and especially on the James River region, in magnetite. For magnitude of extent and facility of exploitation this region is second to none in the United States. As we ascend the successive terraces of the mountains we find the iron deposits folded so as to form numerous outcroppings succeeding each other at short intervals. Over 80 ores coming from the region between Stanton and the James River were analyzed, and none of them contained over 1·2 per cent of phosphorus. Most of the ores contain only from one to five-tenths of one per cent of phosphorus. A year ago Bessemer engineers would have considered this circumstance a great advantage; but with the new processes larger quantities of phosphorus are rendered available and even necessary to obtain the requisite degree of heat in the converter. Taking the whole iron region together the ore will average from 45 to 55 per cent of metal.

To the west of the iron district there are very extensive limestone deposits, and as we enter West Virginia we strike the coal measures. There is a belief current in that region that it is only the lower coal that will coke well, but this is an error. Coal has been found there that will give only two per cent of ash, and the coke formed from it gives but six per cent. As we leave the river banks the coal deposits increase in thickness, until they reach a depth of twelve feet, as, for example, at Hawk's Nest. The valley of the Kanawha River is not one of erosion, but was formed by a geological accident. As a consequence of this the mines that have been started along the banks will have to be abandoned sooner or later and carried over the hills further inland to follow the veins.

It is impossible to tell how much coal there is in Virginia, and nowhere is there so little known about it as in Virginia itself. Since Prof. Roger's report, in 1838, no systematic explorations have been made on account of the difficulty of access. For the want of facilities for transportation, the few iron furnaces that have been run from time to time in Virginia have used charcoal at great expense. During the war the Confederate Government was particularly unfortunate in locating its furnaces near ore containing an exceptionally large amount of phosphorus which they did not then know how to manage.

If the present great revival in the iron trade should continue greater efforts will, no doubt, be made in a few months by the railroads to open up these great mining regions; combinations will be formed between the iron interests of Virginia and the coal interests of West Virginia, and the effect will be to raise the district to the importance of the Pennsylvania iron and coal regions. Then surveys will be made either by private enterprise or by the governments of these States, and the capital of the country will pour in, producing a prosperity such as Virginia has never had. At present these deposits are but dormant wealth for a future generation.

At the conclusion of the paper Mr. Warner gave the fruits of his researches into the mysteries of the "fifteen puzzle," in the shape of a method of determining by inspection whether a given arrangement is or is not capable of solution.

C. F. K.

Proposed Exploration of Mexico.

It is announced that Mr. Pierre Lorillard, of this city, has entered into an agreement with the French Government to assist in the prosecution of a scheme of exploration among the ruins of Mexico. The French Government furnishes the outfit of the expedition and $9,000 in money; Mr. Lorillard gives $20,000 at once, and as much more when it is needed. The whole cost of the expedition for two years is put at $60-000. M. Charnay, the French scientist and explorer, will take charge of the work, which will begin next spring. The material results of the exploration will go to swell the treasures of the French museums. The report of M. Charnay will be first printed in the *North American Review*.

The field to be explored is rich in relics of the splendid though partial civilizations which had flourished for unknown ages, and were in part declining, if not forgotten, when the Spanish conquerors arrived. But, since the days of the ill-fated Maximilian very little has been done toward their investigation except by our government surveyors in Colorado, New Mexico, and Arizona. These have found evidences of an antiquity for the origins of the civilizations of ancient Mexico far exceeding anything dreamed of a few years ago; and it is altogether probable that the questions of historic and prehistoric interest raised by such discoveries may be materially helped on toward solution by the labors of M. Charnay. At least, he cannot fail to add much to our limited knowledge of the later civilizations of Mexico, as shown in the ruins of the Aztec and Toltec cities destroyed by the Spaniards.

Road Engines and Wagons for Western Transportation.

A number of road locomotives and trains of wagons, for the transportation of minerals and general merchandise over the common roads of the far West, were received in this city by the steamship Erin the latter part of February. They were built in Rochester, England, and were consigned to Wadsworth, Nevada, where they are intended to take the place of mule trains on certain central routes in that State.

The engines weigh about 7 tons each, and are rated at 12 to 14 horse power. They have horizontal boilers, which are fitted with large fire boxes for burning almost any description of fuel, and water tanks are affixed capable of holding a supply for three or four hours. The engines are so arranged that they can be used for turning fixed machinery. The driving wheels are 7 feet in diameter and 12 inches in width, and the steering or front wheels are 4 feet in diameter and 9 inches wide. An important advantage in the road locomotive is that in case of need the road wheels can be replaced by the ordinary flange wheels for running on rails.

With the addition of a winding drum, fitted to the driving axle, capable of holding from 50 to 100 yards of coiled rope, these engines can be employed in hoisting heavy weights and in hauling the loaded wagons up otherwise impracticable grades.

It is claimed that one engineer and two laborers are all the manual force necessary for the management of each train, and on moderate roads, with grades not exceeding 1 foot in 12, each engine of the size sent to Wadsworth will haul from 10 to 12 tons of paying load, and travel at an average speed of 3½ miles per hour. Two or three wagons, each capable of containing from 5 to 6 tons weight, and the engine form the train. The wagons are coupled together and to the locomotive by strong coupling bars, and the whole train follows exactly in the track of the engines, even when turning sharp curves. The total cost of hauling by the road locomotives, it is estimated, will range from 5 to 10 cents per ton per mile, varying with the condition of road and load. This is probably not one-fourth of the cost of doing similar work with mules. The ordinary mule team, consisting of 16 mules, with heavy wagons capable of holding 6 to 10 tons, will not average more than 2 miles an hour. The first cost of the locomotive, with its train of wagons, compares favorably with the first cost of the mule team and wagons. It is believed, however, that it will be many years before the traction engines can abolish the use of mules on the Western roads, as the latter may be employed where it would be difficult, if not impossible, for the engines to travel.

The Electric Middlings Purifier.

A public exhibition was given in New Haven, March 13, of the electric middlings purifier, the joint invention of two young men of that city. The working of the device is said to have been highly promising. Over the wire bolting cloths are placed a bank of hard rubber cylinders, which are slowly revolved against strips of sheep skin and thus electrified. To these rollers the light bran is attracted, to be mechanically brushed into a proper receptacle. This substitution of electric attraction for the air blast in separating bran from flour is said to lessen the waste, while it obviates the necessity of doing the work in a closed chamber and the risk of explosions. The exhibition was made in an open room, and there was neither dust nor waste.

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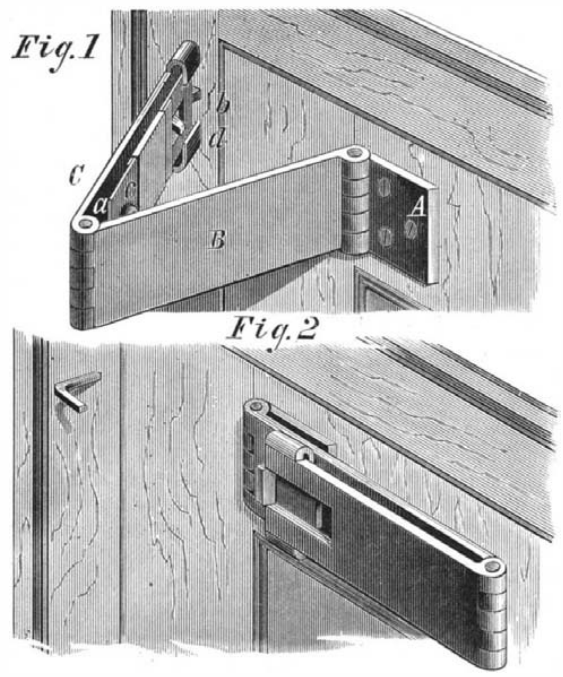
SIMPLE BURGLAR ALARM.

The engravings show a novel alarm recently patented by Mr. Thomas Powell, of Philadelphia, Pa. The inventor has aimed to avoid all objectionable features in these simple and effective little devices, both in regard to appearance and convenience in handling and using. They will meet a long existing want. Only a second of time is required to put them in or out of condition for use. They are applicable to either doors or windows.



POWELL'S WATCHMAN OR BURGLAR ALARM.

Figure 1 is a perspective view of part of a door and door jamb with the alarm set ready for use. Fig. 2 shows the alarm folded against the door so as to be inoperative. Fig. 3 shows the application of the device to a window.

The alarm consists of three plates, A B C, the plate, A, being secured to the door; the plate, B, is hinged to the plate, A; and the plate, C, is hinged to the plate, B. The detonating device, which gives the alarm, consists of two strips, *a b*, of stout paper or cardboard, one overlapping the other, the overlapping portions being bound together by a band so that one strip can be pulled away from the other, creating friction, which causes the explosion of fulminate interposed between the overlapping portions.

The ends of the detonating device thus formed are perforated; one end being held by a stud projecting from the inner surface of plate, C; the other end adjusts itself, when set for use, upon hook, *d*, projecting from the door jamb. When the door is opened the fulminate is exploded, plate, B, being held in position, as shown in Fig. 1, by a lug projecting from its inner side.

In applying the alarm to windows the metallic portions of the device are modified to adapt them to the sliding motion of the window, as shown in Fig. 3. Here the plate, A, is hinged to the side of the plate, C, and a pin, *e*, driven into the casing, is used instead of the hook, *d*.

When the window is raised the hinged plates are carried upward with it, and the detonating device is separated, exploding the fulminate. The same result follows the lowering of the upper sash.

Further information will be furnished by Messrs. Thomas Powell & Co., 521 Cherry street, Philadelphia, Pa.

THE "NEW PATTERN" BLAKE CRUSHER.

The annexed engraving is a sectional view of one of the improved "new pattern" crushers manufactured by Messrs. E. S. Blake & Co., No. 1 Sixth Street, Pittsburg, Pa. It will be noticed that the machine is much more compact than its predecessors, and some of the parts appear to be, and really are, much lighter than in the old machines. This important difference is due to the substitution of wrought iron for cast iron. The most noticeable change is in the pitman, which is now made mainly of wrought iron, reducing it to about one-fifth the weight of the cast iron pitman. This improvement, besides thus lessening the weight of one of the moving parts of the machine, insures it against expensive breaks. Wrought iron has also been substituted for cast iron to a large extent in the frame or bed of the crusher, thus greatly reducing the weight, difficulty of handling, and cost of transportation. Another important improvement has been made in the toggles, so that they work without friction or wear and without the application of lubricants.

In almost all work requiring the use of a crusher, a degree of uniformity in the product in respect to fineness and coarseness is desirable; and it is desirable also that the uniformity shall be maintained without frequent manipulation of any part of the machine. Under the old construction and arrangement, so rapid is the wear of the toggle ends and their bearings, that a frequent drawing up of the "wedge," or the insertion of longer toggles, is necessary in order to maintain in any good degree a uniform distance between the jaws and consequent uniformity of product. But with the improvement to which we have referred, there being no wear of toggles or their bearings, there can be no change in the distance between the jaws except that which results from the wear of the jaw plates; this being extremely slow (in most cases requiring weeks, and in some cases six to twelve months to become appreciable), the variation of distance between the jaws in the improved machine must be correspondingly slow, in many cases amounting to almost nothing.

It will be understood, however, that when a change is desired in the fineness and coarseness of the product, it can be effected by substituting in the usual way longer or shorter toggles, a full set of which of different lengths is supplied with each machine.

In the 15x9 "new pattern" crusher, the pitman (single casting) weighs nearly 1,000 lb. This immense mass of iron has, of course, to be actually lifted at every revolution of the flywheels. The proper number of revolutions for this machine are officially given as 250. It is easy to see that in the old construction a large amount of power must be consumed in throwing this nearly a half ton of iron upward and around at the rate of 250 times a minute. In the improved machine the wrought iron pitman weighs less than 200 lb.

The difficulty of providing an inexpensive "break-down place" in the old "new pattern" Blake Crusher has always been strongly felt as a serious one. And when that style of machine was first offered to the public, the apprehension of expensive parts of the machine (namely, the frame, jaws, and shaft) being fractured by undue, accidental strains led to the addition of an amount of material to these parts which would doubtless have been regarded as quite unnecessary except for the reason referred to, the design of the addition being to throw the liability to fracture on the toggles, as the least expensive of the parts. It will be seen from the engraving that the large bolts which connect the cap or upper box of the eccentric with the parts below, furnish a most desirable, and the best possible protection against injuries to expensive parts of the improved machine. The bolts are made of sufficient strength for all ordinary and legitimate work, but relatively weaker than the other parts; and in the event of any abnormal strain endangering the parts, the weaker of the two bolts will give way, and thus no damage be experienced beyond breaking a single straight bolt, duplicates of which are furnished with each machine.

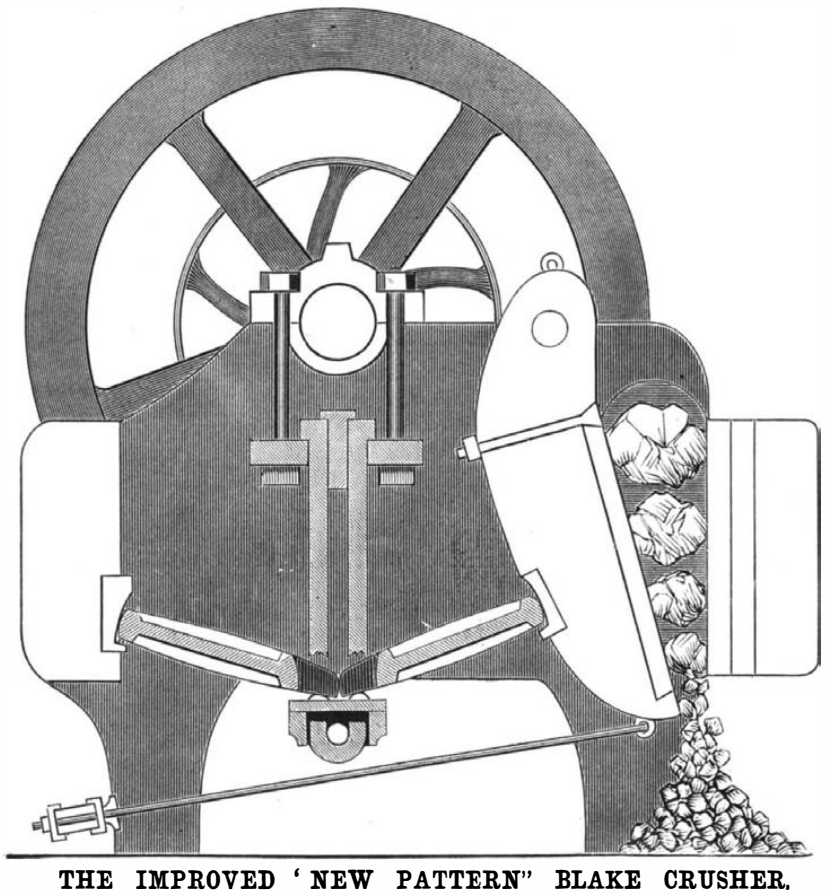
Another improvement consists in the use of friction rollers under the journals of the main shaft, a device which very largely reduces the amount of power required to drive the machine.

The manufacturers anticipate that some of the smaller crushers can be conveniently driven by horse power.

Patents for several of the improvements are pending, while on others patents have been already allowed.

The new machines have been examined and their construction approved by experienced mechanical engineers, and, as might be supposed, are finding a ready sale.

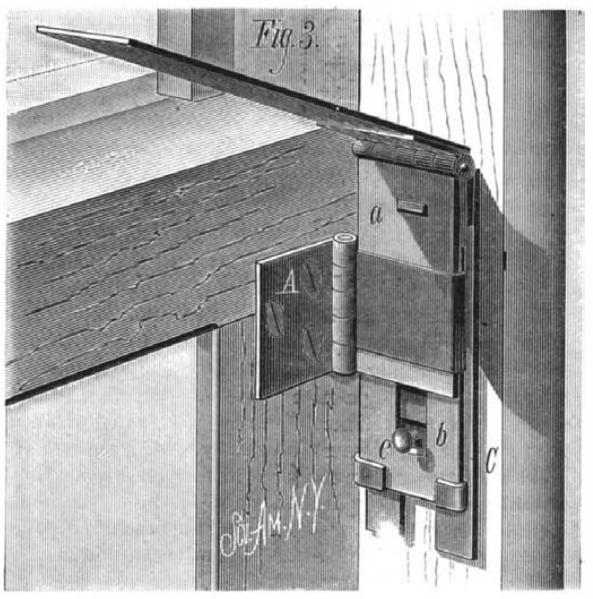
It is a point of no small importance in a crushing machine that the material to be crushed should, in feeding, not require to be elevated. It will be seen that in this respect the Lion and Eagle Crusher, as the manufacturers call it, has the same advantage as the old styles of the Blake machine.



THE IMPROVED 'NEW PATTERN" BLAKE CRUSHER.

MECHANICAL INVENTIONS.

Mr. Nikolaus Kaiser, of Grellingen, Switzerland, has patented an improved mode of drying paper and pasteboard in continuous strips, and in the apparatus employed for that purpose. Heretofore the paper coming from the pressing machine, or other machines, was led over heated metal cylinders, which had the disadvantage that the paper became more or less brittle, thus rendering impossible the use of mechanically ground unboiled wood fiber without other admixture, and also that the cost of plant and working was considerably increased by the necessary employment and working of the expensive metal cylinders required for the purpose. This invention is designed to obviate these defects.



SIMPLE BURGLAR ALARM.

Mr. Frank H. Lauten, of New York city, has patented improvements in feeding paper and other material to printing presses and folding machines, the blanks to the forming and shaping machine for making paper boxes and bags, ruling machines, and for other similar machines wherein the paper or other material requires to be fed in single sheets continuously and in harmony with the operative mechanism of the machine. The improvements also comprehend devices for adjusting the paper on the apron.

An improved machine for cutting the corners of books, cards, and paper has been patented by Mr. Wm. T. Pringle, of New York city. It is of very simple construction and well calculated for the work it is intended to perform.

Mr. Henry L. Russell, of Bloomington, Ill., has invented an indicator lock especially designed for fire alarm boxes, railroad switches, etc., where it may sometimes be desirable to know who unlocked it last, that must be opened with numbered keys, and will register the number of the key that last unlocked it.

Messrs. Richard H. Briggs and James H. Dougherty, of Whistler, Ala., have patented improved mechanism for making ladder irons and hand-holds for freight cars. The machine consists of an ingenious combination of devices which cannot be clearly described without engravings.

An improved cider press, patented by Mr. Gottlieb Ziegler, of Paris, Ohio, will press the juice from any quantity of pomace that may be required without changing the parts of the press. It is also adapted to work more rapidly than the presses now in use.

An improved gate hinge is patented by Mr. James E. Davis, of Palmyra, Ohio. This hinge is designed for the class of gates that are opened by running them back and then swinging them around. It consists in a gate hinge formed of a screw hinged to a pintle provided with a small pulley and placed within a large ring pulley.

Mr. Garritt M. Van Riper, of Bodie, Cal., has patented an improved band sawing machine for cross cutting. The invention consists in a band saw working on pulleys that are fitted movably on vertical shafts, whereby the saw can be moved downward to cut from a log two blocks at once.

An improved paper pulp screen, patented by Mr. Benjamin F. Warren, of Cumberland Mills, Maine, is designed to pulsate the pulp in a simple and effective manner, and it may be adjusted to vary the pulsations as required.

An improved turbine water wheel has been patented by Mr. William B. Farrar, of Greensborough, N. C. This invention has for its object to provide an improved turbine water wheel which shall be simple and inexpensive in construction, but strong, durable, and capable of running at comparatively high speed with moderate pressure or comparatively low head of water.

Messrs. David H. and Jerome H. Payne, of Troy, N. Y., have patented an improved pulley for suspending clothes line.

The line with clothes hanging upon it can be easily pulled around without injury to the clothes.

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AMERICAN INDUSTRIES.—No. 37.

THE MANUFACTURE OF BOOK PAPER.

It is a remarkable circumstance that paper made from rags should have replaced parchment, papyrus, and the whole range of substances used for making records, and come into general use just at the time of the invention of printing, and it is singular that nothing but paper will answer the requirements of the printer.

It is impossible to place definitely the date of the invention of paper. It is one of the things that originated in the remote and hazy past, and like many other things connected with human economies it has been gradually developed and perfected until every condition and requirement in its use seem to have been fulfilled.

It is probable that the first paper from pulp was made in China, and that from thence the art spread over the world. It is not even known when or where linen paper was first made, but it was generally in use about the middle of the fourteenth century.

Until within about a hundred years all paper was made by hand by a slow and laborious process, the supply was naturally limited, and the quality necessarily lacking in uniformity; but the trade was completely revolutionized by the invention of the Fourdrinier machine, by Louis Robert, an employe in the paper manufactory of Francis Didot, in France, in the year 1798. The credit of making the machine practically useful belongs to the Messrs. Fourdrinier, of London, from whom the machine takes its name. The machine was improved in various ways until, in 1806, it was so far perfected as to reduce the cost of paper to about one quarter of the former price.

Within the last fifty years many important improvements have been made in the manufacture of paper. These include the pulp dressing machine; the steam driers attached to the Fourdrinier machine; the rotary cutters which cut the web into any required width, and many other minor yet essential improvements which conduce to the present perfection of paper-making machinery.

Another comparatively recent improvement is the machine for supercalendering, consisting of four paper rolls and four well polished iron rolls, arranged in alternation and placed vertically one over the other. These machines are used for glazing fine papers such as ledger, flat, writing, and fine printing papers. In some instances chilled iron calender rolls are attached to and form a part of the machine, but this arrangement is used only for the lower grades of paper.

Space will not permit of a detailed history of the paper making industry; we have therefore chosen a representative establishment to illustrate the development of this branch of manufacture.

The Albion Paper Company, of Holyoke, Mass., was organized in 1869, when they bought the old wooden mill formerly owned by the Hampden Paper Company of the same place. The mill then had a capacity of 3,500 lb., which was soon increased to 5,000 lb. daily, and the product was used in the manufacture of paper collars. About eight years since the product of the mill was changed to supercalendered book paper; and in 1878, a parcel of land with water power adjoining the old mill was acquired, and a new and extensive brick structure was erected and supplied with the most modern and improved machinery, capable of turning out five tons of paper daily. A year later a second mill similar to the first was built, and filled with the same kind and amount of machinery, excepting that three engines more were added and a few improvements were made. These buildings are shown in the bird's-eye view at the left of the large engraving.

The main mill is 330 feet long by 34 wide and two stories high, with basement and attic. The bleach boilers and rag engines are in the first story, while the second story and attic accommodate the arrangements for sorting and dusting rags. From this building two wings, each 34 feet wide, containing the machine rooms, extend forward 104 feet, and connect with a building parallel to the main mill and forming the street front of the whole structure, which is thus in the form of a quadrangle inclosing an open court. The front building is 210 feet long by 34 deep and two stories high, with attic. The front is relieved by a square tower in the middle, and a similar tower at the rear of the rear mill contains stairways and elevator.

The buildings are so planned that neither stock nor finished paper has to pass over the same ground twice. The Holyoke and Westfield Railroad discharges rags and other materials at the rear, which, in the process of manufacture, pass forward to the finishing room, from which the paper is shipped.

The equipment of machinery, all of which is made in Holyoke, is very complete and modern. Five steam boilers are used to supply the four rotary bleach boilers, each of which, 21 feet long, has a capacity of five tons of rags. The engine room, besides these bleach boilers, contains thirteen 1,000 pound engines and two Jordan engines. There are two Fourdrinier machines, one of 84 and the other of 86 inches; four stacks of supercalenders, 36 inch face, 9 rolls to the stack, one stack, 40 inches face, and a stack of sheet calenders; seven Hammond cutters, and two Cranston trimmers.

The water power from the second level canal is utilized by several of the Holyoke Machine Company's Hercules Wheels. The mill employs 265 hands. It makes some engine-sized flats, but is run mainly on fine book paper, all of which is supercalendered. The buildings are provided throughout with the new automatic sprinklers, which, in case of fire, floods the rooms the instant the heat becomes sufficient to melt the solder which holds the valve.

The material from which the paper is made, in its course through this manufactory, follows a regular order constantly advancing from the place of the entrance of the raw material to the place of exit of the finished product.

The stock is carried by elevators to the attic, where it is first put through an opener or duster, which whips out the greater portion of the dust contained by the rags, opens the folds, and puts them in condition to be examined and assorted. From the attic the stock is dropped to the floor below, where it is placed in baskets and distributed to women to be assorted and divested of buttons, hooks and eyes, pins, etc. After this it is spread out upon large tables and looked over carefully, and pieces of wood, rubber, and other substances likely to injure the paper are removed. The department in which this work is done is represented by one of the views in our engraving.

The stock is now carried forward to the cutting machine (shown in one of the smaller views), which rapidly cuts it up into small pieces, after which it is dusted and let down through hoppers in the floor into huge bleach boilers (shown in the engraving), where they are sealed up and subjected to the action of lime and steam for twelve to eighteen hours. These immense boilers are constantly revolved at a slow speed to bring all of the stock under the action of the bleaching agent.

After this operation the stock is conveyed to the washing engines, where it is washed for six or eight hours, according to the quality; it is then bleached by the application of bleaching powders, after which it is allowed to run through valves in the bottoms of the washers to brick drainers in the basement, where it is allowed to remain from two to four weeks.

The half-stock, as it is now called, is put into the beating engines, where the fiber is brought out to the required length. Of these machines the Albion Paper Company have six, also seven washers, making a total of thirteen. engines. The lower view in the engraving represents the long row of engines used in the establishment. In these engines the rags are drawn between the cutters on the large revolving cylinder and the stationary cutters in the bottom of the vat, and are torn into the finest filaments. The stock goes round and round in this machine, being acted upon by the cutters again and again, the huge cylinder carrying the cutters being meanwhile gradually lowered by the mechanism seen at the side of the vat, until the stock is reduced to a fine pulp. The thin pulp is allowed to run out of the engines into wooden chests, whence it is pumped up into the tank of the Fourdrinier machines. From this tank the pulp flows into a small chamber, where it is kept in constant agitation until it flows out over a channeled plate—upon which extraneous matters of greater specific gravity than the pulp are arrested—and is delivered to an endless wire cloth apron, which is continually agitated to insure an even distribution of the pulp fiber. The wire cloth apron is supported on a series of small rollers, and the width of the paper is governed by deckle straps at each side. The wire cloth apron passes over a box in which a partial vacuum is maintained, which withdraws a part of the moisture from the paper as it passes over the box.

The paper is delivered by the wire cloth apron to a felt apron, which conveys it to the first pair of press rolls which expel the moisture and deliver it to an apron which carries it forward to a second pair of press rolls, where more of the moisture is removed and the web is still further compressed; it is then passed to another blanket which delivers it to a series of steam-heated rolls. These rolls, as well as the other portions of this machine, must move in absolute harmony, and the mechanism must be of the most perfect character to handle the thin and extremely tender web of moist paper. The paper, as it is delivered by the machine, is in rolls. This mill has two Fourdrinier machines, one producing paper 76 inches wide, the other 79 inches wide. These machines are of Rice, Barton & Co.'s make. The paper is cut into different widths, as it is delivered to the reels, according to the requirements.

The finishing room adjoins the machine room, and all of the paper is passed through the calender rolls until a high finish is obtained.

The machinery of the Albion mills consists of 13 (1,000 lb. each) engines; two Jordan engines; four rotary boilers for rags having a capacity of five tons each; two Fourdrinier paper machines (84 and 86 inches wide). The calenders consist of four stacks having 9 rolls each, 36 inches wide; one stack 40 inches wide; one stack for calendering sheets.

The capacity of the mills is twelve tons of book paper per day.

The water supply, which must of necessity be pure and clean, is derived from driven wells, 115 in number.

The officers of the company are as follows: Calvin Taft, President; Edward C. Taft, Treasurer and Agent; A. H. Page, Clerk. These gentlemen also comprise the stockholders of the company. The entire mill is under the management of Mr. William Reardon.

Habits of Fishes.

It has been long known that fishes return to about the same place in the same rivers each year to spawn, but it is a recent discovery that they go up the left hand side of the stream and coming down take the opposite side Fisher men may be benefited by remembering this.

Correspondence.

The Value of Vaccination.

To the Editor of the Scientific American:

Your issue of March 6 contains a letter from an English correspondent upon the subject of vaccination. Without going over the immaterial portions of his letter, those only of importance are, first, in relation to bovine and humanized lymph. Are they equivalent, and is vaccination performed with one considered equally protective by those who believe in vaccination as that performed with the other? He smites the air vigorously to establish what no one denies, namely, that they are equivalent and equally protective. Having gained this important vantage ground, he proceeds, in the second place, to show by statistics from various hospitals of Great Britain, that during ten years, irregularly and imperfectly observed, 37,636 cases of smallpox occurred, and that 28,468 of these were reported as vaccinated. This he brings forward as irrefragable proof that vaccination is an "unparalleled failure."

Now, this is the statement which in some form or other has been put forward as the strong argument against vaccination ever since agitation of the subject commenced.

Simply stated, it is this, that three-fourths of all the cases of smallpox treated in the hospitals of Great Britain have been vaccinated, consequently vaccination is valueless. Let us examine this statement, and in order to do so it is necessary first to determine what constitutes vaccination. In the January number of the *Popular Science Monthly* for the current year is an article entitled "Vaccination in New York." It is a statement of the methods and results of vaccination as practiced in this city, in contrast with the statements of Mr. Moncure D. Conway regarding the results, as he pictures them, in Europe, and especially in England.

I have there given the careful and exact methods of vaccination as practiced by the vaccinating corps of the Board of Health of New York, and a large class of intelligent practitioners of medicine, and the results obtained in the way of protection.

These results concisely stated are as follows: Vaccination, in order to be protective, should be done with eight-day lymph, either from a healthy infant or from the calf. The vesicle should be characteristically perfect on that day. The vaccination so performed should produce a similar perfect vesicle upon the eighth day and run its normal course.

Those who have given their attention almost exclusively to this subject for the past ten years, in connection with the Board of Health and in public institutions, recording cases and noting their behavior when subsequently exposed to smallpox, unhesitatingly declare their belief that such vaccinations are a perfect protection against the disease; at least to the same extent as though it had been experienced.

In support of this statement and belief numerous cases are cited, and the number could be *indefinitely increased* where, during the epidemic of 1874–5, among members of the same family, the unvaccinated, almost uniformly, when exposed, took the disease, while there is not a case of an individual who, having received the inspector's certificate of vaccination, subsequently contracted the disease, even though living for days in close rooms where it existed.

Another remarkable fact bearing upon this subject is the following, as reported by Dr. Taylor, Inspector of Vaccination. It was the custom, during the epidemic of 1874–5, where a mother having an infant at the breast was attacked by the disease, and was obliged to go to hospital, to immediately vaccinate the infant, and then send both mother and child to the smallpox hospital, a place at that time crowded with cases of the disease in every stage of progress. As a result of this procedure not a single infant so treated took the disease, notwithstanding the fact that the infant was nursed by the mother throughout her illness.

The belief of those who have been the most diligent students in this matter, is that one perfect vaccination protects through life; nevertheless a certain small percentage of those vaccinated in infancy only take the disease when exposed in later life. It is therefore advised that children vaccinated in infancy be revaccinated about the fifth or sixth year. So also as a safeguard against possible infection it is advisable that vaccination even in adults should be repeated, and especially at some time of unusual exposure, such, for instance, as must occur in epidemics of the disease.

It is not claimed that the rule of protection is absolute and without exception, any more than other rules and laws in the economy of nature. The fact of having once had smallpox is usually considered the best possible protection against future attacks; and yet cases occur where the disease is experienced twice and even more times by the same individual.

So persons who have been vaccinated according to the suggestions above laid down are considered thoroughly protected, though one case of smallpox in a very great number might possibly occur among them.

It is only persons who have been so vaccinated, and who have received all the protection which vaccination is capable of affording, who can properly be counted in arranging statistics upon this subject.

Now, what knowledge has your English correspondent concerning the 28,468 cases of smallpox which are reported as vaccinated? How many of these have ever *really* been vaccinated? How many of those really vaccinated have fulfilled the conditions necessary to thorough protection by the perfection of the virus used, a proper method of vacci-

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nation, and, if necessary, revaccination? How many belong to the class which even smallpox itself does not protect from a second attack? Unless your correspondent is informed upon these points his statistics are useless. Yet it is just such loose statements and unreliable statistics as these that are constantly and invariably brought to bear as strong arguments against vaccination. They are specious, and perhaps calculated to deceive the multitude, but they betray that ignorance both of the subject and the proper use of statistics which certainly characterizes most of those writers and agitators who are at present directing their efforts against vaccination. R. OSGOOD MASON, M.D.

64 West 20th St., New York.

Dangers of Fire from Steam Pipes.

To the Editor of the Scientific American:

I would have replied ere this to Mr. Atkinson's letter, which appeared in your paper of February 21, were it not that I wished to complete some experiments on the ignition of wood and charcoal, the results of which I give you below; but before going further, it would be well to define the difference between seasoned wood, charred wood, and charcoal.

The first admits of no degree; it is simply wood with the sap and the excess of moisture, above what would be incidental to the hygrometric state of the atmosphere.

The second admits of degree, and is wood with the hydrocarbons partly driven off, according to the completeness of the charring.

The third admits of no degree, and is nearly pure carbon and ashes.

I inclosed a two inch cube of white pine wood within a small gas pipe retort, with a bit of solder (one-third tin and two-thirds lead) and a bit of sheet lead, and placed the retort in a boiler tube for five days, boiler going day and night. At the end of that time the wood was pure charcoal, the solder was melted, and the lead was not, which goes to show pure charcoal can be made at a temperature between 500° and 612° Fahr.

To prove the above was pure charcoal, *i. e.*, that all the hydrocarbon was driven off, I raised the temperature of the retort to about 1,200°, but could not drive off any more gas.

In October, 1877, I inclosed pine laths against the shell of a horizontal boiler, and covered them with a course of brick on edge. The pressure of steam in this boiler has been 40 to 60 lb. day and night since, except one day a month for cleaning. The ends of the laths that came out to the air and flush with the brickwork, are not near as dark as hemlock tanned leather, and the darkest part I could find which was entirely covered with brick is not as dark as roasted coffee. This goes to show charcoal cannot be made at 300° Fahr., after two and a half years, under the most favorable circumstances, with a furnace fire only five feet beneath it.

To prove this wood was not charcoal, I placed it in a retort and drove off gas that burned with nearly as much light as illuminating gas, when it leaves the retort.

In experiments on the ignition of charcoal, I found that the charcoal made in the boiler tube would not redden at the melting point of lead (612° Fahr), but would at a lower temperature than zinc (770° Fahr.).

My mode of operation was this way. I passed a gas pipe through a fire and blew pure air through the pipe. I also prepared myself with long slender strips of solder (half and half, and one-third tin and two-thirds lead), and with strips of lead and zinc, and pine shavings, and small pieces of the laths and charcoal.

The pure charcoal would not redden in the same blast that just melted the lead, but did in a blast which melted it rapidly. When held in a blast which melted solder (one-third tin and two-thirds lead, melting temperature about 500° Fahr.), it showed no signs of fire or redness.

The lath, which was two and a half years in contact with the boiler under a course of brick, would become charcoal in a temperature which melted half and half solder, but would not get a spark on it until I increased the temperature to where the needle of lead bent and dropped. The same with a nicely prepared splinter of white pine, in which I could see no deviation in the action from the splinter of the lath; they all became charred in the blast which melted half and half solder, but would not take on a spark until the lead melted.

With a blast that fused a metal 19 parts tin, 31 lead, and 50 bismuth, melting temperature about 212° Fahr., I could not turn tissue paper brown.

Gunpowder held in the blast which melted the lead did not explode until after the lead melted. It gave off a slight blue sulphurous light first, then the lead melted, and an instant after the powder exploded.

The statement I made in my first letter I now repeat, "that the temperature at which wood and charcoal fire is between 500° and 700° Fahr.," and that the purer the charcoal the higher the temperature required.

Illuminating gas will not take fire from a cherry red poker, but will from a bright red one.

The gas of wood, crude petroleum, soft coal, or any other hydrocarbon, will not take fire when escaping hot from the retort. With a cherry red poker I have tried the three mentioned.

I now wish to say that it was not my intention to make any of the readers of your journal careless in construction, and I would be sorry should my remarks, in answer to Mr. Smith's letter, be the cause of loss to any of them.

I know insurance companies act on the principle that "prevention is better than cure," and that the results in many cases justify their acts few will deny; but questions of fact must be answered yes or no, and not by the *modus vivandi* of the insurance agent.

I will comment on the points in Mr. Atkinson's letter as they occur, and will then try to show where the real danger lies in the use of boilers and steam pipes.

Is it not more likely that the wood of the "open boiling keir" was darkened in color by the oxide of iron from the nails than charred by the temperature of boiling water at atmospheric pressure, conducted through the length of the nails into the wood, and is not this *rusty* appearance often taken for charring?

The "fine charcoal" under some conditions might be classed with damp cotton, slack of soft coal, or lampblack; but while workmen are allowed to carry matches in their vest pockets, it would be safer to associate it with the matches, especially in the face of all the steam pipes that are packed in charcoal, and one in particular in California, where high pressure steam is carried 2,600 feet into a mine packed in charcoal.

The steam pipe "through the sill" prepared it for fire by drying it, and the dropping of a match, the fire from a cigar, or the superheating of the steam by getting low water in the boiler, could start it into active combustion. The same remarks will apply to the floor beam.

"Oiled waste cotton or wool and greasy overalls" have taken fire from being locked in a tool chest, *without* the aid of a steam pipe.

I will now endeavor to show why any one, whether insured or not, should comply with the requirements of the underwriters with regard to steam pipes and boilers, especially the latter.

When a journeyman, working in New York city, I was sent to John Hecker's house, in great haste, to see what the matter was with the steam heating apparatus. As soon as I entered the hall door I "smelled a burned boiler," and when I reached the boiler room I saw one. The generator was a sectional pipe boiler, and was red hot, with the pipes badly warped, and the fire still in the furnace. Upon investigation I found that the hair felt and canvas covering was charred through, the latter being as brown and crisp as burned leather for a distance of about fifteen feet, and beyond that, for about fifteen more, it showed signs of charring, lessening with the distance. It surprised me the house did not take fire, for, instead of having steam at a *maximum density* in the pipes, it was at first *superheated* (cause, very little water in the boiler), and as the pressure found vent through the burned boiler (as some of the tubes were burned through), it must have been red hot air or gas which filled the pipes, and nothing but the want of circulation prevented it from carrying the heat to the small uncovered pipes throughout the house.

This is not the only case that came under my notice. The First National Bank of Pittsburg had nearly the same experience when the janitor, in the fall of the year, fired two horizontal multitubular boilers for three hours (8 A.M. to 11 A.M.) before he discovered anything wrong. He then came to look for me, and did not find me until 1 P.M. The boilers were still hot, and the uncovered pipes near the boilers were turned blue black, the same as if they had just left the welding furnace and cooled; but where they were covered, the composition did not fall off, it being one of the lime and asbestos mixtures. Another case was a private house in Detroit, where the blow-off cock was opened maliciously, and the Chalmer-Spence covering was charred and destroyed, and had to be replaced on the boiler, and for about six feet beyond it on the main steam pipe.

I cite the above to show there is danger from superheated steampipes, and though the superheating of pipes is not an every day occurrence, it is safe to say they are more frequent than boiler explosions.

The following, though not generally recognized, often cause fires:

(1) The sudden closing of a damper on a fresh fire is apt to send flame or sparks through any cracks in the brickwork of a boiler.

(2) A *back draught.* The explosion of carbonic oxide, which sometimes takes place when any one opens the furnace door and admits air, where a lazy fireman has heaped coal on a dirty fire, which partly decomposes the coal by the heat of the fuel already in, but does not produce complete combustion for the want of sufficient air.

(3) The leaving of *banked fires* over night, with doors open or partly open, and dampers shut or partly shut, which, under some conditions, make small explosions of gas or throw hot coals by the bursting of slate in the fire out through the door.

The raking out the remnant of a wood fire at quitting time, which, though it be ever so well done, is attended with great danger from sparks.

The excessive heat from upright boilers, smoke pipes.

The taking fire of soot, of soft coal, or wood, which will never show itself, or never can assume active combustion, when the fire in the furnace is going, as the carbonic acid gas from one fire will not support a second in the smoke pipe; but should the first fire be low or out, the air will pass rich in oxygen to the second, and redden it, thereby heating the smoke pipe.

WM. J. BALDWIN.

ELMIRA, N. Y., March 13th, 1880.

Astronomical Notes.

OBSERVATORY OF VASSAR COLLEGE.

The computations in the following notes are by students of Vassar College. Although merely approximate, they will enable the observer to recognize the planets. M. M.

POSITIONS OF PLANETS FOR APRIL, 1880.

Mercury.

Mercury rises before the sun on April 1, but so near to the sun that it is not likely to be seen.

Mercury will be near Jupiter on the morning of the 8th, near Venus on the morning of the 15th, and will be at the greatest elongation west on the 26th. It rises at that time nearly an hour before the sun, and should be looked for about 12° south of the point of sunrise.

Venus.

Venus rises on April 1 at 4h. 51m. A.M. Venus will be near Mercury on the morning of the 15th, and near Jupiter eight hours later.

On April 30 Venus rises at 4h. 19m. A.M., nearly at the same hour at which Saturn rises, Venus being north of Saturn.

Mars.

Mars is the only planet visible to the eye which can be seen in the evening.

Its motions can be followed by connecting it with prominent stars in the constellations of Taurus and Gemini. On April 1 Mars rises at 9h. 15m. A.M., and sets 32m. after midnight. At meridian passage on April 1 Mars is 4° east of Beta Tauri, and 3° below the star in altitude. The crescent moon passes Mars on April 15.

On April 17 Mars will pass Mu Geminorum 2½° above the star. On the 23d Mars will pass Gamma Geminorum 8½° above the star. On April 26 Mars will have the same right ascension with Sirius, but will be more than 40° above Sirius.

On April 30 Mars rises at 8h. 36m. A.M., and sets at 11h. 48m. P.M.

Jupiter.

Jupiter ranges so nearly with the sun that it is not likely to be seen until the latter part of April, when it should be looked for before sunrise. Jupiter will be near Venus April 15. Jupiter rises on April 30 at 3h. 44m. A.M., almost exactly in the East.

Saturn.

Saturn rises so nearly with the sun that it is not likely to be seen during the early part of April.

Venus, Saturn, and Mercury rise nearly at the same time on April 30.

Uranus.

Uranus is in very good position for amateur astronomers, and is easily found with small telescopes. On April 1 it passes the meridian at 9h. 47m. P.M., at an altitude, in this latitude, of 58°. It has nearly the same right ascension as Rho Leonis all through the month; it is ⅓° above this star on April 1, and ½° above it on April 30.

A telescope of low power, which would give a large field of view, would bring the star and the planet into the field together.

Uranus may also be found 6½° east of Regulus, and 2° south of that bright star, early in the month.

39½ Messages an Hour.

The following are the best total records of the Western Union main office operations from February 1 to 15 inclusive:

DAY FORCE (PRINTERS).

Calvert	4,523	Noyes	3,577
Miler	3,596		

MORSE.

McLaren	3,795	Allen	3,583
Irving	3,698	Barberie	3,458
Harmon	3,644	P. J. Tierney	2,962
Brick	3,634	Hutchinson	2,979

NIGHT FORCE (MORSE).

Shain	4,078	Robinson	3,256
R. W. Martin	3,542	Case	3,177
Anson	3,374	Hinman	3,027
Sabine	3,313	Risdon	3,309

The highest average was made by Printing Operator Calvert, which was 39½ messages per hour.

Leif Ericsson's Wild Oats.

Mr. Ernest Frölich, of Christiana, Norway, thinks he has found in our Indian rice a living proof of the truth of Snorre Sturlson's history of Leif Ericsson's visits to this country nearly nine hundred years ago. The voyagers reported finding in Vinland not only an abundance of wild grapes, but a kind of grain which they called wild oats, growing plentifully along the marshy river sides. This grain, which they said the natives used for food, can be no other he thinks, than the well known Indian rice, or wild rye (*Zizania*), which grows almost everywhere along the swampy borders of our coast streams as well as around inland lakes and ponds. Mr. Frölich proposes to follow the example of our Western game preserving associations, who are sowing wild rice in our marshes for the benefit of wild fowl, by sending home seed for planting on Norwegian marsh lands and moors.

Rapid Railway Building.

The greatest feat in the way of rapid railway making is said to be that of Sir R. Temple, in the late Afghan campaign. One hundred and thirty miles of railway was constructed in one hundred and one days.

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ENGINEERING INVENTIONS.

Mr. John L. Cole, of Williamstown, Mass., has patented improvements in apparatus for checking the momentum of railroad cars and storing power to be subsequently used in starting or impelling the car, which apparatus consists, generally, of springs, a cord or chain, a conical spirally-grooved winding drum, and gearing and clutches for connecting the drum with the car wheels or axle, whereby the cord is wound on the drum, the springs compressed and held for use in propelling the car by their expansion.

An improvement in rail joints, patented by Mr. William W. Fay, of Jefferson City, Mo., consists in connecting the ends of adjoining rails together by means of a metal plate inserted in slots in the adjacent ends, and also in fastening and tightening the connecting plate in its place by means of laterally-driven dovetailed wedges.

Mr. Samuel L. Skinner, of Independence, Iowa, has patented a device for automatically restoring to their proper position the car wheels that may chance to run off the track while the cars are running. The invention consists of eccentric wheels with V-shaped grooves in their treads, adjusted on a car truck, and operated in such a manner that when the car wheels leave the rails the eccentric wheels will at once drop upon the rails and operate to raise the truck in line again, so that the car wheels will be restored to their proper position.

SCISSORS AND SCALE MEASURE.

This device consists essentially of a round rod or tube having a slot, within which is secured one blade of a pair of scissors, the other blade being held in the open position by means of a spring.

COMBINED SCISSORS AND SCALE.

In using this implement the operator grasps the rod in the right hand and inserts the fourth finger in the bow of the scissors. The goods to be cut are drawn over the rod with the left hand under the movable blade, when the scissors are closed, cutting the goods.

The inventor claims that this implement combines the usefulness of two instruments, while it offers no inconvenience in the use of either scissors or scale.

This improvement is the invention of Mr. Scott Stivers, of Liberty, Ind.

A Primitive Nation.

The new Mexican interoceanic railway across the Tehuantepec Isthmus is marked out to pass through the State of Chiapas, which probably contains the only population in the world which possesses no iron, nor anything in the shape of an iron industry even of the crudest form. For the distance of eighty miles around Palenque, the capital, not a single blacksmith can be found, and the only articles in the shape of iron are axes and machetas, imported from the United States. Nails are unknown, all the woodwork being held together by cords or the tendrils of the vines, and even the tortilla is prepared by grinding the maize between stones. The new railway, which will run through this territory, has clearly a well defined educational as well as a commercial development to undertake.

Winter Fishing on Chautauqua Lake.

The winter fishing on Chautauqua Lake is a good deal of a business. Being an inland lake it freezes over quicker than Lake Erie, and when the latter body is open Chautauqua Lake has ice enough to hold up an army of fishermen. There are now about twenty "coops," as they are called, out on the ice. A "coop" is a box about three feet square, with a hole in the bottom. A hole is cut in the ice and the box is placed over it, and it being perfectly dark in there he can see the bottom as plain as day if the water is clear. If it is not clear, a newspaper is sunk to the bottom under the coop, and fish passing over it are easily seen Through this hole in the ice a wooden fish properly weighted is sunk to the proper depth, and with a cord attached to it, the bogus fish is made to fly around lively, and thereby attract other fish to its locality. The man in the coop keeping watch, seeing a fish in good position, lets drop his heavy spear, weighing from fifteen to twenty pounds, fastening him to the bottom. Some large fish are caught in that way. The Monday before New Year's there were caught three pickerel weighing respectively twenty-seven, thirty, and forty-two pounds. It is quite a business when the pond is frozen over, and those who follow it make money.—*Silver Creek (N. Y.) Local.*

IMPROVEMENT IN JACKSCREWS.

The engraving represents a marked improvement in a simple yet most important mechanical appliance which is indispensable to those engaged in building or repairing houses, ships, engines, bridges, or railroads. It is known as Ball's patent jackscrew, and is manufactured by Mr. Albert Bridges, 46 Cortlandt street, New York city.

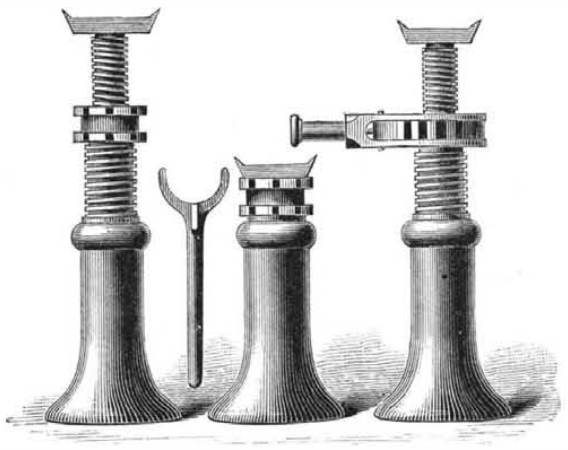


Fig. 1. Fig. 2.

BALL'S TELESCOPIC JACKSCREWS.

The screw, as will be seen by reference to the engraving, is double, the lower part being made tubular and threaded both externally and internally; one screw to the right and one to the left. The two screws operate simultaneously. The internal thread receives a solid screw carrying at the top a cap which is applied to the object to be raised.

The upper end of the tubular screw is provided with a head adapted to a wrench, as shown in Fig. 1, or it is provided with a ratchet head, as shown in Fig. 2. With this construction, when the tubular screw is turned, it not only raises the solid screw, but the latter being stationary, it is evident that it must be projected from the tubular screw at the same rate of speed as the latter is projected from the base, providing all of the threads are of the same lead.

It is stated that this jack will raise a load in one half the time required by the ordinary jack without an increase of labor. The screws may be run out nearly double the height of the base.

The stands vary in height from ten to twenty-five inches; the screw from fourteen to forty inches; the rise varies from eleven to thirty-six inches; and the total length ranges from twenty to sixty-one inches.

It is stated that there are 5,000 of these jackscrews in use.

Negatives on Paper.

M. Londe lately exhibited some negatives upon thin paper (*dioptrique*). It appears that this gentleman prepares a plate with talc and pours over it a collodio-bromide emulsion. When the negative has been obtained he floats over its surface a solution of gelatine and gum, and then lays the thin paper upon it, passes a squeegee over it to drive out excess of liquid, and allows it to dry. When thoroughly desiccated a sharp knife is passed round the picture about an eighth of an inch from the edge of the plate. The film is now lifted from the glass, and can be used on either side for printing purposes.

IMPROVED PLANT SPRINKLER.

The invention shown in the annexed engraving will be appreciated by lovers of flowers and plants, as it affords a

SCHRADER'S PLANT SPRINKLER.

convenient means of showering, and is not limited as to its supply of water. It consists simply of a rose sprinkler connected with a flexible bulb provided with a couple of valves and a suction tube. The pail containing the water may be of any convenient size. To operate the sprinkler it is only necessary to alternately compress the bulb and allow it to expand. When it is compressed it expels the water through the rose sprinkler. When it is allowed to expand it draws a fresh supply of water from the pail.

This invention was recently patented by Mr. August Schrader, of New York city.

Points about Welding.

The *Blacksmith and Wheelwright*, a journal that ought to know, says that to obtain a good sound weld, the following points should be observed:

The scarf should be sufficiently larger than the finished size to permit the weld to be well drawn out after welding. The joint surface of the scarf should be slightly rounding, so that, when the two pieces are placed together to weld, there will be no air inclosed between them.

They should be heated in a clear fire of bright and not gaseous coal. Thick pieces should not be heated too quickly, or the interior metal will not be brought up to the required temperature. They should be frequently turned in the fire, to insure uniformity of temperature, and be made as hot as possible without burning them.

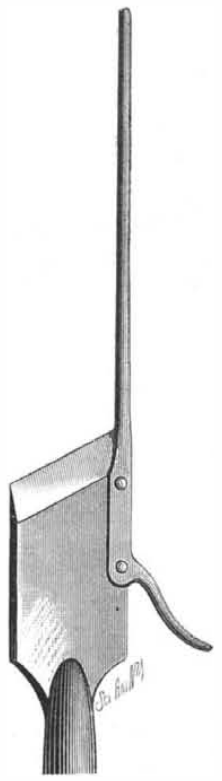
They should be withdrawn from the fire occasionally, and sprinkled with sand, which serves to exclude the air from the surface and prevent oxidation, and at the same time cools the outer surface and thin edges, giving the interior metal and thicker parts time to become heated all through.

When the pieces are placed upon the anvil to weld them, they should be quickly cleaned with either a wire brush or a piece of wood made ragged by having been hammered. The scarfs should be placed to well overlap each other, and should receive light and quickly succeeding blows at first, and heavier ones afterward.

As soon as the pieces are firmly joined, the hammer blows should be delivered with a view to close the edges of the scarf, so that the joint of the weld shall not show where the job is finished.

IMPROVED PRUNING IMPLEMENT.

The principal object of the invention shown in the annexed engraving is to provide a guide for the pruning chisel, so that when the thrust is made to sever the limb the chisel will be properly guided so that the stroke will be effective. The invention consists of a long tine or finger attached to one of the edges of the chisel, and extending forward in the direction of the thrust of the chisel. The fixed end of this tine is bent outward, forming a hook, by means of which the limbs cut from the tree may be pulled out.



COGSWELL'S PRUNING IMPLEMENT.

This simple yet useful invention has been patented by Mr. John W. Cogswell, of Erie, Mich.

Pneumatic Clocks.

The Paris correspondent of the New York *Herald* has thought the following of sufficient importance to transmit by cable to New York:

Paris clocks have long afforded a subject of ridicule to foreigners. In a few days there will be no room for derision. Within the last week handsome public, illuminated timepieces have been erected in the middle of the causeway of the leading thoroughfares. These are all in communication with the works of the new Pneumatic Clock Company, in the Rue St. Anne. By means of subterranean tubes this company receives the time direct from the Observatoire every morning, and regulates all the timepieces in connection simultaneously. In future it will be possible to have the correct time laid on in any house, like gas or water, at the trifling cost of from three to five centimes per clock per day. I was allowed to inspect the company's premises privately to day, and examined the whole arrangements. The air is compressed by steam engines and driven at intervals of a minute through the communicating tubes, so as to move the minute hands the requisite distance at each pulsation. It can be applied to any clock. The company undertakes to pay all the cost of the fittings. It supplies clocks gratuitously and charges only a subscription. By this new system all trouble of repairing and winding up is done away with. Over one thousand pneumatic clocks are ordered in Paris already, and will soon be tested at New York, where the patent for America has been purchased.

Another New Jersey Fossil Sea Serpent.

The jaws and a portion of the vertebræ of a fossil sea serpent (*Pythonomorpha*) were found not long since in a marl pit at Marlborough, New Jersey. Professor Lockwood estimated the length of the living serpent to have been from 40 to 60 feet—considerably less than that of a previously discovered specimen. Tooth-marks on the bones indicate a grand feast of ancient fishes when the dead monster "lay like a great wreck on the old ocean bed." The teeth, though formidable, are about half the size of those of the 80 foot specimen previously discovered.

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NEW LUBRICATOR FOR STEAM ENGINES.

We give, on this page, two views of a novel engine lubricator, recently patented by Mr. A. L. Harrison, chief engineer of U. S. revenue cutter Samuel Dexter, Newport, R. I., one view showing the exterior in perspective, the other being a vertical central section.

This lubricator is designed to effect a regular and continuous lubrication of the cylinders and valves of the engine to which it is applied. The lubricant is supplied in regulated quantities, forced in against the steam pressure by atmospheric pressure obtained by the use of a vacuum chamber or by the use of a water column.

The oil and pressure chamber, A, is formed of two concave disks bolted together on a flanged ring, B, clamping the flexible diaphragms, C, leaving a small space between them. A single diaphragm might be used, but two are preferred, with the space between them filled with glycerine or other non-freezing liquid, forming a flexible partition between the diaphragms, which prevents unequal stretching and equalizes the pressure. This space is filled through openings in the ring, B, which are closed by screw plugs.

At the under side of the chamber, A, there is a tube, D, through which passes a rod, E, whose inner end is rigidly connected to the center of the diaphragms, C, by means of clamping washers. To the lower end of this rod is secured a handle by which the rod may be moved to draw the diaphragms to the bottom of the chamber, A. This rod also carries a piston fitted to the cylinder, F, on the lower end of the tube, D.

At the upper side of the chamber, A, there is an oil cup, G, used in filling the lubricator and tube, H, for the discharge of oil from the chamber, A The cup, G, and tube, H, communicate with the chamber, A, by separate passages fitted with cocks, J and I, respectively.

On the upper end of the tube, H, there is a chamber, K, the sides of which are made of glass. In the bottom of this chamber there is a small opening communicating with the tube, H, and on the top there is an opening provided with a tube leading to the parts to be lubricated. The chamber, K, is to be filled with glycerine.

To the under side of the chamber, A, two pipes are connected, having communication separately with the space beneath the diaphragms, and are each fitted with a cock.

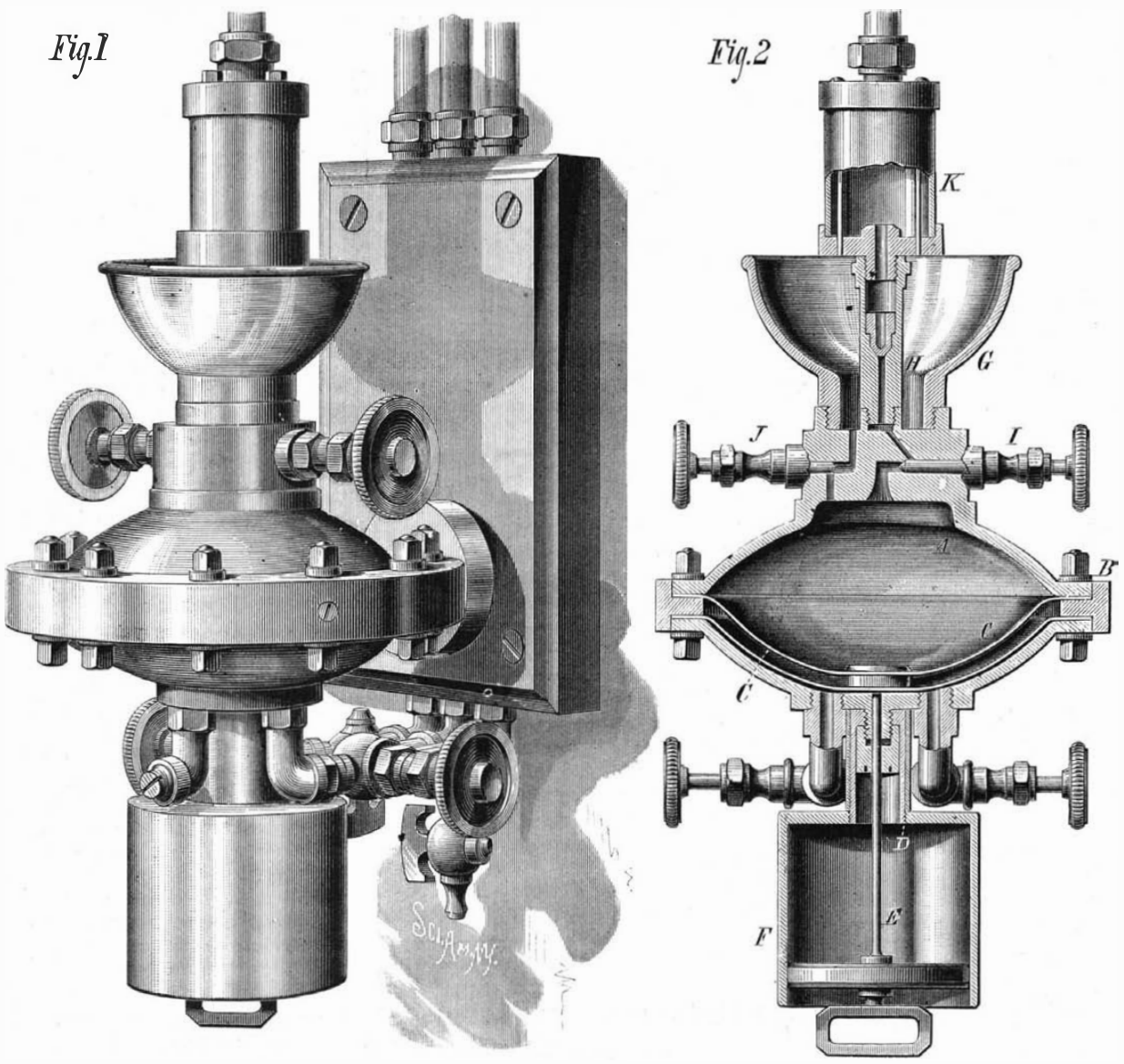
One pipe is to be connected with the exhaust of the engine when the lubricator is used in connection with condensing engines, and the other pipe is to be connected with the steam pipe from the boiler. This connection permits of the attachment of the lubricator to the engine or to a wall, as may be desired.

The lubricator is provided with a second exhaust pipe that opens into the tube, D. and cylinder, F. and is fitted with a pipe for connection with the exhaust of the engine. This pipe has a two-way cock for closing connection between the cylinder, F, and engine exhaust, and opening connection between the cylinder and the outer air or the reverse, as may be required.

To charge the reservoir, A, with oil, the oil is first poured into the cup, G, and the cock, J, is opened to allow the oil to enter the reservoir, and one of the cocks below the reservoir is also opened so that the space below the diaphragm may be exhausted by the pipe connected with the exhaust of the engine. The diaphragm is thus drawn down and the oil drawn into the reservoir. The cylinder, F, will at the same time be opened to the outer air.

The reservoir, A, being thus filled, the cocks, J and I, are closed, and the exhaust pipe is put into communication with the cylinder, F, and steam is admitted below the diaphragms. The diaphragms are thus balanced by steam pressure, and the cylinder, F, being exhausted, its piston is forced inward by atmospheric pressure, carrying the rod, E, and diaphragm, C, upward, forcing oil through the pipe, H, into the glycerine chamber, K, in drops at more or less frequent intervals or in a continuous stream as circumstances may require, the flow being regulated by the valve, I. From the glycerine chamber, K, the oil flows through the tube to the engine cylinder. This lubricator, when applied to high pressure engines, is operated by the gravity of a water column instead of atmospheric pressure. This device, although apparently complicated, is really very simple and well calculated to fulfill the requirements of a first class lubricator.

For further particulars, address the inventor, as above.



HARRISON'S LUBRICATOR FOR STEAM ENGINES.

The Great Glaciers of Alaska.

The Stickine is perhaps better known than any other river in Alaska, because of its being the way back to the Cassiar gold mines. It is about 350 or 400 miles long, and navigable for small steamers to Glenora, 150 miles, flowing first in a general westerly direction through grassy, undulating plains, darkened here and there with patches of evergreens, then curving southward, and receiving numerous tributaries from the north, it enters the Coast Range and sweeps across it to the sea through a Yosemite Valley more than 100 miles long, and 1 to 3 miles wide at the bottom, and from 5,000 to 8,000 feet deep, marvelously beautiful and inspiring from end to end. To the appreciative tourist sailing up the river through the midst of it all, the cañon for a distance of about 110 miles is a gallery of sublime pictures, an unbroken series of majestic mountains, glaciers, falls, cascades, forests, groves, flowery garden spots, grassy meadows in endless variety of form and composition—furniture enough for a dozen Yosemites—while back of the walls, and thousands of feet above them, innumerable peaks and spires and domes of ice and snow tower grandly into the sky.

About 15 miles above the mouth of the river you come to the first of the great glaciers, pouring down through the forests in a shattered ice cascade nearly to the level of the river. Here the cañon is about two miles wide, planted with cottonwoods along the banks of the river, and spruce and fir and patches of wild rose and raspberry extend back to the grand Yosemite walls. Twelve miles above this point a noble view is opened along the Skoot river cañon—a group of glacier-laden Alps from 10,000 to 12,000 feet high, the source of the largest tributary of the Stickine.

Thirty-five miles above the mouth of the river, the most striking object of all comes in sight. This is the lower expanded portion of the great glacier, measuring about six miles around the snout, pushed boldly forward into the middle of the valley among the trees, while its sources are mostly hidden. It takes its rise in the heart of the range, some thirty or forty miles away. Compared with this the Swiss *mer de glace* is a small thing. It is called the "Ice Mountain," and seems to have been regarded as a motionless mass, created on the spot, like the rocks and trees about, without venturing a guess as to how or when. The front of the snout is about 300 feet high, but rises rapidly back for a few miles to a height of about 1,000 feet. Seen through gaps in the trees growing on one of its terminal moraines, as one sails slowly along against the current, the marvelous beauty of the chasms and clustered pinnacles shows to fine advantage in the sunshine; but tame indeed must be the observer who is satisfied with so cheap a view.—*San Francisco Bulletin.*

MISCELLANEOUS INVENTIONS.

Mr. James T. Cochran, of Brooklyn, N. Y., has patented a horseshoe designed to prevent the horse from interfering, slipping, or injuring the hoofs in any way. It will allow the hoofs to expand properly, and is so arranged as to avoid contact with the sensitive part of the sole. The shoe is provided with a toe calk having a smooth unbroken beveled surface on the inside, a straight surface on the outside, and separated from the side calks by V-shaped notches.

Mr. James H. Hayes, of Cerro Gordo, Ill., has patented an improved nut lock, which is simple, convenient, and effective. It consists in a nut lock formed of U-shaped springs, which is provided with small lugs at the forward ends, and is designed to prevent two or more nuts from turning.

An improved recording ballot box has been patented by Mr. James G. H. Buck, of Dallas, Texas. The object of this invention is to indicate accurately and instantly the result of an election; to prevent the possibility of rifling the box of its ballots, or of stuffing it with fraudulent ones.

An improved sled, which is so arranged that it can be propelled and regulated in speed and direction by the person seated on it, has been patented by Messrs. Alfred Hitchiner and John W. Heaton, of Lawrence, Mass. The invention consists in a sled provided with a standard to which two slotted bars having hooks at the lower ends are pivoted, these bars being grasped by the person on the sled, and used to propel it and to press against the brakes, which are pivoted to the end of each side of the sled.

Mr. John A. Musselman, of Steinsburg, Pa., has patented an improved cooking stove. The object of this invention is to combine with a cooking stove an auxiliary heating stove, so arranged that it can be used either separately from the cooking stove or in connection therewith, as may be desired.

An improvement in lamps has been patented by Mr. Frank R. Kimball, of Boston, Mass. The object of this invention is to prevent any flow of oil to the burner except in the form of vapor, and to supply the oil automatically to the vaporizer in quantities as required; also, to construct the oil reservoir in a form adapted for ready application to or removal from an ordinary street lamp.

Mr. John Wampach, of Shakopee, Minn., has patented an improved fifth wheel. The object of this invention is to improve vehicles so that their wheels may pass over uneven surfaces without wrenching or twisting the gearing.

An improvement in water heaters, patented by Mr. William R. Hinsdale, of Garden City, N. Y., relates to apparatus for heating water by steam while circulating through pipes, as in dwelling houses, directly to the wash basins, bath tubs, laundry tubs, or other places of use, or to hot water heating apparatus in dwelling houses, stores, or buildings, such apparatus being particularly adapted for use where cities or towns are supplied with steam for heating and other purposes through street mains and a water supply under pressure.

Fatal Effects of Fog.

A single week of raw and densely foggy weather more than doubled the death rate of London, compared with the average for the corresponding week for the preceding years. The weekly reports of the Registrar-General show that the annual death rate had risen steadily during the three weeks preceding the foggy period from 24·6 per thousand to 27·1 and 31·3; then it bounded to 48·1, a rate higher than had been recorded since the cholera epidemics of 1849, 1854, and 1866. While the increase in deaths in the West End districts of the metropolis did not exceed 32 per cent, in the crowded quarters at the East End it was equal to 83 per cent. The largest number occurred among people past sixty years.

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A Mountain takes the Place of a Lake.

Interesting particulars begin to come in with regard to the effects of the series of earthquakes experienced in San Salvador toward the close of last year. The severest shocks were felt in the neighborhood of Lake Ilopango, which has always been regarded of volcanic origin.

On December 21 the earthquake movements were particularly marked, and accompanied by a horrible rumbling sound beneath the earth, which, more than its tremblings and oscillations, spread terror through the already alarmed population. That night no fewer than 150 distinct shocks were felt, and the people abandoned their houses in dismay. During the succeeding days of the month the movements continued, and on the night of the 31st a tremendous subterranean detonation was heard, like the discharge of heavy cannon, succeeded by three successive shocks of great violence, which were felt throughout the entire republic, and, in the immediate theater of their action finished the ruin their predecessors had begun. In the vicinity of the lake a rainstorm followed, of such violence as has not been experienced for years, the rush of waters carrying to the lake vegetation, soil, trees, and everything in their way, making huge gullies, rendering useless some valuable lands on the margin of the lake. The waters of the lake, instead of appearing to be increased by this large addition to their volume, actually diminished.

As the water retired conical-shaped peaks or hills appeared in the center of the lake, while the water surrounding them was in a state of commotion as though it were boiling, and on examination it was found that its temperature had materially increased. From the highest of these peaks, which are constantly increasing in size, smoke, vapor, and flame issued, the column rising as high as that which issues from the Izalco, and may be seen from the capital, a distance of several leagues. The central hill of the group thus forming appears to be increasing in size more rapidly than the others, people in the neighborhood estimating its growth as prodigious. The water of the lake has gradually resumed its level and raised in height as the process of formation of the volcano continued, escaping through its outlet at an immense rate. It is thought that it will soon be emptied into the sea and the mountain will take its place.

The volcano keeps regularly at work, occasionally sending up showers of stones, which, falling on its sides, add to its dimensions. Since it has begun its functions in such a marvelous manner the shocks of earthquake have ceased, although at intervals the subterranean noises are heard, but only in the immediate neighborhood of the burning mountain. The vapors which issue from it are heavily charged with sulphurous materials, which produce a nausea, and in many cases have induced sickness, mostly fevers. With the beginning of the volcanic activity springs broke out in various places, some of potable water, and others horribly fetid and disgusting. Mr. Goodyear, State Geologist, will probably soon issue a report upon the remarkable phenomena involved.

VENUS' GIRDLE.

This pretty creature is found in the Mediterranean, where it attains the extraordinary length of five feet, the breadth being only two inches. The mouth of the Venus girdle is in the center of the body, occupying a comparatively small space. The body is ribbon-shaped toward two opposite sides from the mouth. The edges of the ribbon-like body are serrated or provided with numerous little lips, by means of which the creature propels itself forward. It can also propel itself from one place to another by a peculiar spiral movement.

The Venus' Girdle, with its magnificent colors, is a most beautiful object. Various attempts have been made to keep them in aquariums, but they survive for a few days only. They are attacked by the other animals in the aquarium, and have such a ravenous appetite that it is almost impossible to supply them with sufficient food. When touched they immediately roll themselves up into a regular spiral.

Owing to its great length and tenuity the Venus' Girdle is seldom found quite entire, but it seems to care little for a foot or so of its substance.

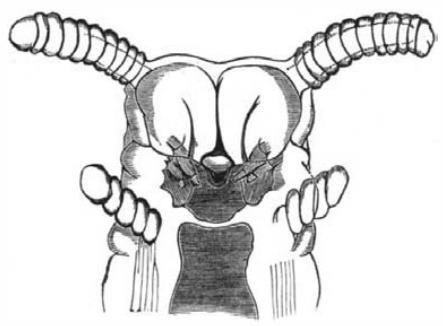
The Spirilla-Spirochætes.

It has been pretty conclusively proved by Obermeier that relapsing fever is due to the entrance into the blood of this minute air-born vegetable organism. In further proof of this, we are informed by the London *Medical Record*, January 15, 1880, that Vandyke Carter, in India, has injected under the skin of monkeys defibrinated blood proceeding from patients suffering from relapsing fever, and which contained spirillæ. On the sixth day the monkeys were attacked with violent fever, and the blood was filled with spirillæ. Cohn, of Breslau, has further cultivated this spirilla in successful culture fluids outside of the body, and reproduced feverish attacks with the third or fourth culture fluid.

PERIPATUS CAPENSIS.

In his interesting "Challenger Notes," writing from the Cape of Good Hope, Mr. H. N. Moseley says:

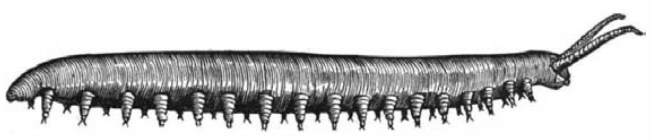
I stayed at Wynberg for a fortnight, while working at the anatomy and development of *Peripatus capensis*. Peripatus is an animal of the very highest importance and antiquity, and I believe it to be a nearly related representative of the ancestor of all air-breathing arthropoda, *i. e.*, of all insects, spiders, and myriapods.



HEAD OF PERIPATUS CAPENSIS MAGNIFIED.

The animal has the appearance of a black caterpillar, the largest specimens being more that three inches in length, but the majority smaller. A pair of simple horn-like antennæ project from the head, which is provided with a single pair of small simple eyes. Beneath the head is the mouth, provided with tumid lips and within with a double pair of horny jaws.

The animal has seventeen pairs of short conical feet, provided each with a pair of hooked claws. The skin of the animal is soft and flexible, and not provided with any chitinous rings. The animal breathes air by means of tracheal tubes like those of insects. These, instead of opening to the exterior by a small number of apertures (stigmata) arranged at the sides of the body in a regular manner, as in all other animals provided with tracheæ, are much less highly specialized. The openings of the short tracheæ are scattered irregularly over the whole surface of the animal's skin.



PERIPATUS CAPENSIS. (Natural Size.)

It appears probable that we have existing in peripatus almost the earliest stage in the evolution of tracheæ, and that these air tubes were developed in the first tracheate animal out of skin glands scattered all over the body. In higher tracheate animals the tracheal openings have become restricted to certain definite positions by the action of natural selection.

The sexes are distinct in *Peripatus*. The males are much smaller and fewer in numbers than the females. The females are viviparous, and the process of development of the young shows that the horny jaws of the animal are the slightly modified claws of a pair of limbs turned inwards over the mouth as development proceeds; in fact, "foot-jaws," as in other arthropods.

Before I studied *Peripatus* at the Cape nothing was known of its manner of development, nor of the fact that it breathed air by means of tracheæ. It was generally placed with the annelids, though its alliance with the myriapods had been suspected by Quatrefages.

That *Peripatus* is a very ancient form is proved by its wide and peculiar distribution. Species of the genus occur at the Cape of Good Hope, in Australia, in New Zealand, in Chili, in the Isthmus of Panama and its neighborhood, and in the West Indies. If its horny jaws were only larger they would no doubt be found fossil in strata as old as the Old Red Sandstone at least.

The animal is provided with large glands, which secrete a clear viscid fluid, which it has the power of ejecting from two papillæ, placed one on either side of the mouth. When the animal is touched or irritated it discharges this fluid with great force and rapidity in fine thread-like jets. These jets form a sort of network in front of the animal, which looks like a spider's web with the dew upon it, and appears as if by magic, so instantaneously is it emitted. The viscid substance, which is not irritant when placed on the tongue, is excessively tenacious, like bird-lime, and when I put some on a slip of glass some flies approaching it were at once caught and held fast. It appears from the observations of Captain Hutton on the New Zealand species,* that the jet of slime is used by the animal not only as a means of offense but to catch insects, on which the animal feeds.

I found only vegetable matter in the stomachs of the Cape species, and concluded that the animals were vegetable feeders. The animals live at the Cape in or under dead wood, and I found nearly all my specimens at Wynberg in Mr. Maynard's garden in decayed fallen willow logs, which were in the condition of touchwood. I tore the logs to pieces and found the animals curled up inside.

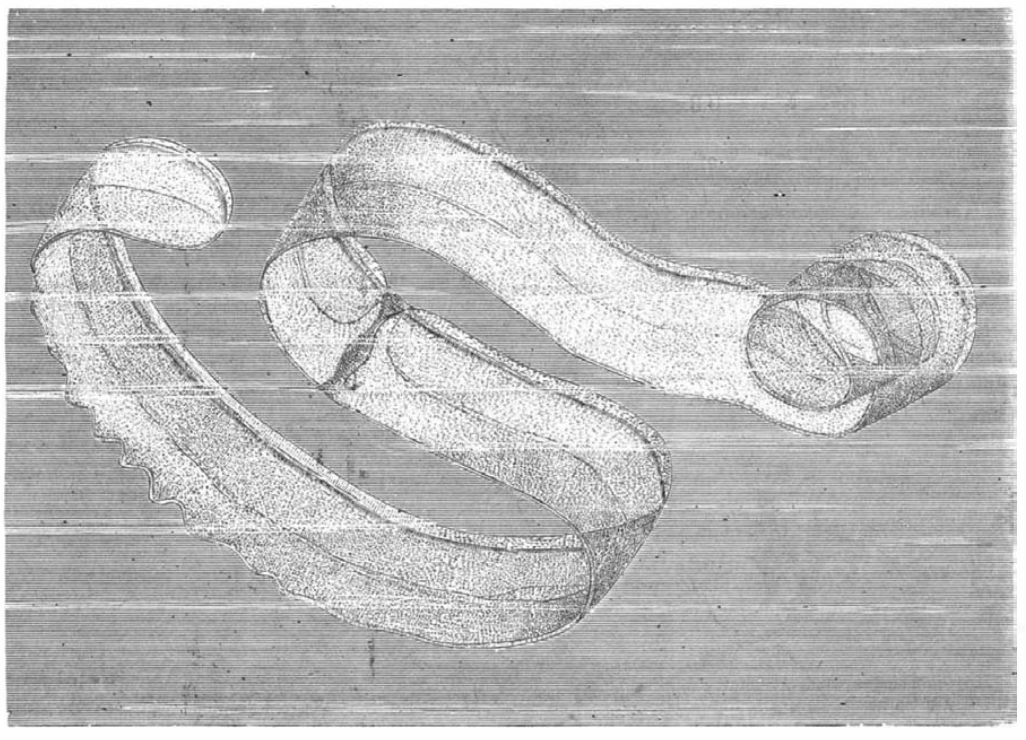
The animals are very local, and not by any means abundant, so that an offer of half a crown for a specimen to boys did not produce a single example.

My colleague, the late Von Willemnes Suhm, and I both searched hard for *Peripatus*. He was unsuccessful; but I was lucky enough to find a fine specimen first, under an old cart wheel at Wynberg. Immediately that I opened this one I saw its tracheæ and the fully-formed young within it. Had my colleague lighted on the specimen he would, no doubt, have made the discovery instead.

Peripatus capensis is nocturnal in its habits. Its gait is exactly like that of a caterpillar—the feet moving in pairs and the body being entirely supported upon them. The animals can move with considerable rapidity. They have a remarkable power of extension of the body, and when walking stretch to nearly twice the length they have when at rest.

Had I not been engaged for so long a time in working at *Peripatus* I should have certainly paid a visit to the Knysna Forest, accessible by steamer from Cape Town, which contains wild elephants preserved by Government, and numerous antelopes, and other large animals.

[For a detailed account of the anatomy and development of *Peripatus capensis*, see H. N. Moseley, "On Anatomy and Development of *Peripatus Capensis*," Phil. Trans. R. Soc., 1874, p. 757. The engravings and description here given are from the "Challenger Notes."]



VENUS' GIRDLE.—(*Cestum Veneris.*)

How a Botanic Garden is Formed in Japan.

The following extract from a report from Hakodate, Southern Yesso, says the *Gardener's Chronicle*, will indicate the aptness of these intelligent people, the Japanese, to seize a new idea from a foreigner:

"An inkling was given to three of the principal native storekeepers by a lady to start a botanical garden. The idea was jumped at, as this was the very thing they had always desired to have, the Japanese being so very fond of flowers, and more especially foreign flowers; but the individuals in question, who are brothers, did not know how to set about it, and what seeds to order, and when they had them, what to do with them. Accordingly a plan for a garden was drawn up, and some one having an idea of gardening was engaged, after which a spot of ground was selected most suitble for a flower garden; but when application was made for it the Kaitakushi took the matter in hand, and has now started a public garden, the foreign directress still being consulted on all matters. In order to give it the character of a public undertaking, every ward of the town was induced, in succession, to work there one whole day, besides the regular coolies paid by the Kaitakushi. When the whole town had thus contributed its quota of labor, all the singing girls of the tea houses, with the other inmates of these establishments, dressed up in gay colors, were engaged there one whole day in smoothing down the paths with a stone fastened to ropes handled by about a dozen girls each, singing and dancing all the time; and, to crown all, one Sunday all the officials, from the highest to the lowest, dressed in laborers' working clothes, were engaged in finishing the '*fusiyama*' of the garden, without which no Japanese garden is complete."

* Captain F. W. Hutton, "On Peripatus Novæ Zealandiæ, Ann." and Mag. Nat. Hist., 1876, p. 363.

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SPECTERS IN THE AIR.

BY CHAS. B BOYLE.

Had the causes of the mirage been understood, life and property might often have been saved, and, as utilizing that knowledge is one of the objects of this paper, it may be well to consider the subject in chronological order.

The accompanying diagram is given by Sir David Brewster as the geometrical exponent of fits of extraordinary atmospheric refraction, to which he attributes the phenomenon of the mirage, by which he means that the earth's atmosphere is subject to *fits of refraction*, so extraordinary that objects on the surface of the earth may appear at times elevated above it at angles as great as thirty or forty degrees. If the earth's atmosphere is subject to such excessive changes in its refractive energy, how happens it that the sun, moon, or stars never appear displaced by it, even when seen over the horizon where the greatest amount of displacement by refraction occurs, and where they are never affected by refraction beyond a single degree?

In astronomical observation no greater amount of refraction is ever obtained at the horizon than one degree, and as the angle of observation above the horizon increases, the atmospheric refraction decreases, till at the zenith it is nothing. The varying amount of atmospheric refraction at the horizon, where it is greatest, is never more than five minutes of a degree, and the only visible sign it gives is the slight enlargement of the apparent size of the sun or moon, and their appearance and that of stars above the horizon a few seconds in advance of their true time. If, when examples of the mirage are occurring, we direct a telescope along the line of the mirages, we shall find that our instrument is seeing in straight lines, which would not be the case if the line of vision were passing through an atmosphere of varying density. While engaged in locating a lighthouse at sea and sighting an object on a distant mountain side, the line of vision frequently passed over vessels and under their images in the air, and, therefore, through the section of atmosphere which Sir David's theory assures us was then undergoing a fit of *extraordinary refraction*, but in no case did the reading of the angles vary in the slightest degree from those obtained at other times. Indeed, if the earth's atmosphere were subject to fits of extraordinary refraction, the sciences of engineering, navigation, and astronomy could have no existence, for then neither the telescope nor the naked eye could see in straight lines, and, consequently, triangulation of any kind would be practically impossible beyond the limits of a straight edge. A navigator might find his true place upon the ocean to-night by measuring the angular position of a star under normal conditions of atmospheric refraction; to-morrow night another navigator might be in the same spot and undertake to find his place upon the ocean by measuring the angular position of the same star, but might find it varying from one to forty degrees from what it read upon the previous night, if the medium through which it had to be observed were subject to fits of *extraordinary refraction*, and, as it would be impossible to determine at any given moment the amount or direction of the displacement, finding latitude and longitude by the stars would be impossible, and, if attempted, would be certain to lead to disaster; whereas, all navigators place the most implicit confidence in those celestial observations, which they could not do if the atmosphere were subject to fits of *extraordinary refraction*, nor would it be possible to map any portion of the earth's surface.

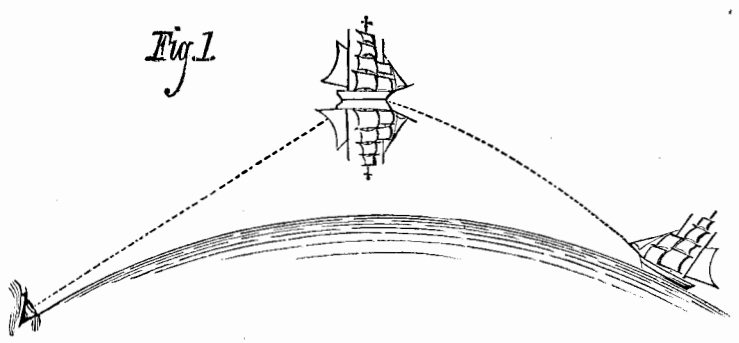
Imagine an engineer triangulating for the purpose of mapping a coast line, without the means of knowing when his telescope was seeing in straight lines or when it was not, and never being able from moment to moment to determine how much or how little its line of vision was deflected from the line of its axis, if at all. Determining the trend of a coast in a world where such conditions existed would be simply impossible. The same is true of surveying lines of railroads, canals, and all kinds of engineering, where long sights are a necessity.

The region through which the Suez Canal has been built, is one where the phenomenon of the mirage is of most frequent occurrence, but the engineers have in no instance experienced trouble by having their lines of vision deflected from the axis of their telescopes. Why, if the earth's atmosphere were subject to fits of extraordinary refraction, a map of the heavens could not be made, as no observer could tell when a star was displaced or the amount or direction of the displacement; even marksmanship could not exist, as a hunter might be firing at the image of a deer which was, in fact, behind an adjacent hill many degrees away from the line of the shot. Firearms to shoot round corners would then be in order.

If, from the facts observed, we measure the position of the ship and that of its image in the air, we shall find the quantity of refraction too great to be obtained, even by a medium varying in density from atmosphere to glass; so slight, in fact, is the variation in the density of the earth's atmospheric conditions that we require the most delicate instrument to measure it, and the most extreme amount indicated by the mercury is never sufficient to perceptibly deflect a ray of light passing through it; no barometrical observations have ever recorded at any place or at any time any change in atmospheric density that would warrant the theory of extraordinary fits of refraction.

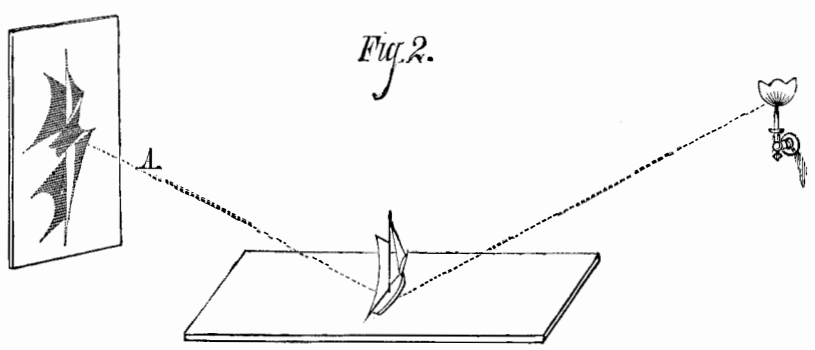
Now, let us observe what takes place while we try some experiments which we can bring under our immediate control. Lay an ordinary sized mirror, say twenty-four inches long, down upon a table with the mirror side up, setting on

Fig. 1.



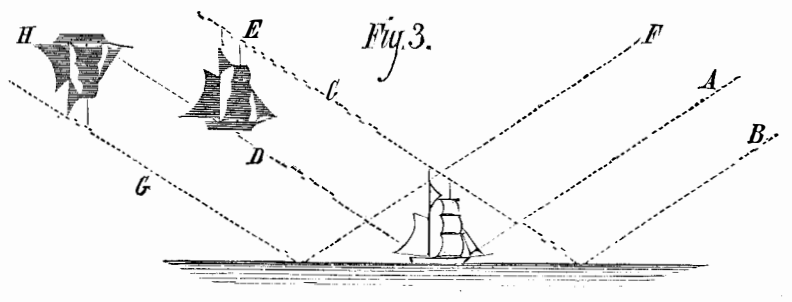
the glass, at about its middle, a toy ship or boat with sails, made of paper, if we please. Let the bottom of the boat's hull be flat, so that it will stand in upright position and crosswise on the glass, "athwart ships" of the mirror, then hold a light above and beyond one end of the mirror, as shown in diagram 2, the light from which, after falling upon the mirror, is reflected in the direction A, where, being intercepted by a screen, it presents two images of the ship, one right side up and one wrong side up, with their bottoms

Fig. 2.



apparently together. If we remove the mirror and put in its place a dish of water with the ship afloat in it, the result will still be the same, with the exception that the images will be less distinct, owing to the fact that the surface of the water reflects less light than that of the mirror, but if we increase the brilliancy of the flame, the distinctness of the images at A will increase in proportion, and when the instrument be placed in the sunlight they remain quite distinct, even when projected upon thin gauze and when the distance from the

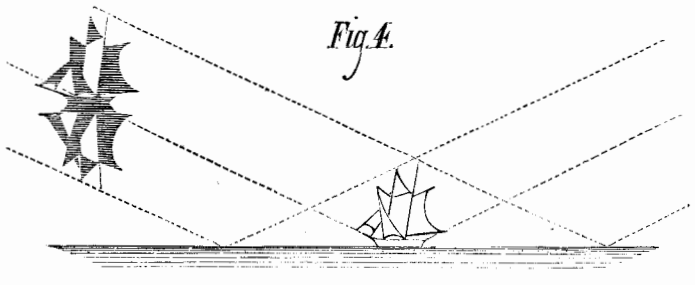
Fig. 3.



ship is much increased. We have, then, in this experiment the sun, the ship, the water, and the peculiar combination of images in the air, which constitute the most remarkable examples of the mirage in nature.

The results are identical; there can only remain a question as to the identity of the causes. That the images seen in the air become visible by being projected upon intercepting clouds there can be no doubt, because it is not possible to make images projected in air visible unless by their interception. Just as the pictures projected by a magic

Fig. 4.



lantern are everywhere in the air between the screen and the camera, yet are visible nowhere but on the screen, so the images of the ship are everywhere present in the air between the ship and the image, but remain invisible till their interception by a screen, as may be proved by holding the screen in the experiment at any distance from the toy ship along the line of the reflected images, where it may everywhere be shown, but nowhere in empty space. And as nature has no other screens in air but clouds, they must be the backgrounds which, by intercepting those images, make them visible. This, however, has been put beyond a doubt by a case witnessed in this city, where a number of people saw the image of a burning brig, which was six or seven miles distant, distinctly visible on the smoke of some asphaltum, which had accidentally caught fire in the street where they were.

In every case where the time of day is mentioned with the observation of the phenomenon, we find that it occurred when the sun was low; thus the observation made by Mr. Gresham took place about four o'clock in the afternoon; we also find that it is much more frequent in the Arctic seas than elsewhere, because there the sun is always low, while in the lower latitudes it is low only in the early and later portion of the day. The causes of its more frequent occurrence when the sun is low is due to the fact that the reflected image makes a correspondingly low angle with the surface of the water, and is therefore much more likely to be intercepted by clouds before making its exit from among them into space, than if it were reflected from the surface at angles nearer to the perpendicular, in which case it would stand but little chance of interception by those wandering backgrounds. Indeed, it is impossible for the sun to shine upon moderately still water without reflecting back to heaven images of all things resting on its surface or about its edges with sufficient elevation above it to cast shadows upon its surface. It is only upon exceptional occasions that any of those images are intercepted by a cloud screen, and when that happens we call it a mirage, specters in the air, etc. When but a single image of a ship at sea is seen in the air, it is due to the fact that the intercepting cloud screen is in position to receive but one of its shadows, for both are projected from the ship in every such case. If the right side up image is visible without the other, then the cloud is too high to intercept the lower one, and if the wrong side up or inverted image is exhibited without the other, then the cloud is too low to intercept the upper image, as may be seen by the third diagram, where A B is a sheaf of sun rays falling upon the water on the sunward side of the ship and reflected back into space along the line, C D, carrying with it a shadow of the ship right side up, which, being intercepted by a cloud at E, becomes visible there. The lines, A F, bound another sheaf of rays, which project a shadow of the ship on the water beyond it, which being reflected into space along the lines, D G, and intercepted by a cloud at H, becomes visible there, thus accounting for the phenomenon of an erect image of a ship presenting itself in one part of the heavens and an inverted image of the same ship in another part at the same time; this, however, is so rare a combination of cloud, ship, and sun that is very seldom witnessed, and when it is, it most usually happens that only fragments of both images are seen, because the accidental passing of the clouds is more likely to bring them but partially into the paths of the shadows. More frequently it happens that one image, or one image with a fragment of the other, makes its appearance, because of the accidental distribution of the cloud screens which intercept them; but when this background is sufficiently large and posed in the path of both shadows, then both images appear in the same place, as shown in the fourth diagram. Even an almost imperceptible mist will serve to make those images visible, as may be shown by placing in the path of the artificially produced image a thin gauze, which will show the air phantoms, when received, from either side. The double image, however, is a phase of the phenomenon which can only occur when the object from which it is projected is surrounded by the reflecting surface, hence its occurrence most frequently at sea; it may occur on land, however, when the object is surrounded by plains turned into reflecting surfaces by recent rain, where numerous little pools, wet vegetation, etc., become the equivalent of a mirror, more or less broken, it is true, but as all the pools, however great or small, assume one common horizontal surface, they are the equivalent of a fractured mirror, which acts in the case precisely as if it were not broken when the reflection takes place from the upper surface. An example of this kind was witnessed at Petersburg, Va., where the image of a church standing near was seen in the air; fortunately, the observer incidentally remarked, without seeming to suspect that it had any connection with the production of the phenomena, that the time was about four o'clock in the afternoon and that a thunderstorm had just passed over. The observation made in this city supplies the rest, for the exhibition began with the breaking out of the sun from behind a cloud and ended with the existence of the column of smoke that supplied the background.

When an object is located on the shores of the reflecting surface only a single image of it can appear in the air, and this will be right side up, if the sun is on the water side of the object, or inverted, if the source of light is on the landward side, because when the shadow of the object is cast upon the water before reflection takes place, the reflected image is always bottom up, but when the light is reflected from the water before encountering the object, the shadow projected is always erect, as may be seen by the fifth dia-

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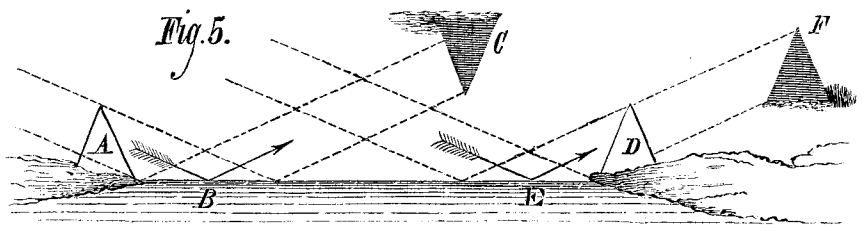
gram, where the sun is assumed to be on the left hand side, where also is the obelisk, A, the shadow of which is cast upon the water at B, and thence reflected to the cloud, C, where it appears inverted. The obelisk, D, is on the opposite side of the water, therefore the sunlight falls upon the surface at E, and is reflected upward before encountering it; but when it does encounter it, the obelisk cuts its form out of the light, which shadow proceeds onward and upward with the reflected light, until it is arrested by the cloud, F, where it is made visible right side up.

This last example of the air pictures was beautifully shown in a case observed on the south coast of England. A windmill stood upon a promontory with an eastward shore. The sun was rising, and an erect image of the windmill was seen in the air to the westward, obviously projected upon the morning mist. As the sun ascended so did the image, because the angle of reflection being equal to the angle of incidence, it must ascend from the reflecting surface at the same angle at which the sun shone down upon it, or that at which its light was incident upon it, but in proportion as it ascended it became less distinctly defined, and finally disappeared by gradually fading away, because the morning mist increased in attenuation in proportion as its altitude increased above the water. The image also moved northward at the same rate that the sun moved southward, in this also obeying the law of reflection; for the sun, the mill, and the image must, of necessity, occupy a perpendicular plane common to them all. As the mill was stationary and the sun in motion about it, all shadows of the mill cast by the sun must, of course, move about it in the opposite direction to that in which the sun was moving, precisely as if the sunlight and the shadow were opposite and connected radiates of the mill, just as when the sun is in the east it casts its shadows to the west, and as it moves westward it casts them more eastward, pointing east when the sun is due west, and west when the sun is due east, or always opposite the sun. All aerial images produced by this phase of the mirage are shadows *only* of the objects they represent, and, like all shadows, present only outline forms. They are frequently observed inland, and, if their causes were understood, might at times serve very valuable purposes.

Recalling the case of a party of trappers with laden animals crossing some of our Western wastes and perishing for want of water, yet seeing in the air the image of an eagle, right side up, perching upon the branch of a dead tree, and superstitiously regarding it as an ill omen, instead of comprehending that it was a messenger sent by the sun to say that if they turned their faces toward him he would lead them to water in a very short time, yet still toiling past, unwittingly rejecting the proffered relief, is one of the melancholy prices we often pay for the luxury of ignorance or of false interpretation of natural phenomena. The real eagle was seated on the branch of a dead tree which stood on the nearest edge of a sheet of water not, probably, half an hour's journey from them, for images projected by small objects cannot be visible far from their original source, for, like all shadows, they consist of the actual and penumbral shadow, the latter fading away with the distance and the former growing smaller. As even the branch of the tree was shown in this case, the probability is that the water was not more than a mile away, yet they toiled on past it to many a death of horse and man. The sun not only projects double shadows of all objects upon water, lying in the path of its rays, away from it, but also forms in air real pictures of the sides of the objects which are turned toward it, especially if those sides are wet. The mode of reflection by which this occurs is illustrated by diagram 6, where the sunlight breaking through a cloud in such a manner that its light falls upon the water at A, upon the sunward side of the ship, the lower edge of the cloud, B, prevents the sun rays from illuminating the ship. The light is reflected from A on to the object, and thence back and upward in the sheaf of reflected rays, C D, to the cloud, B, where a picture is presented with many details not to be found in the shadows of the object, which are cast in the opposite direction or away from the sun. This order of reflection is occasionally reversed by the cloud, B, having its upper instead of its lower edge bounded by the line, C, when the direct sun ray will illuminate the ship, from whence it will be reflected to the water at A, and thence on to the intercepting cloud below the line, C. The image formed by the latter modification will be inverted and that of the former erect.

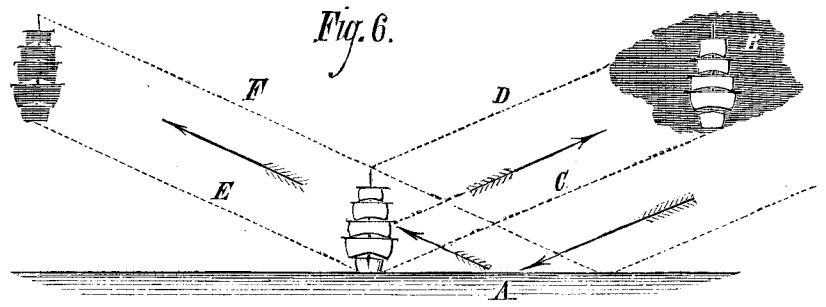
It is to this phase of atmospheric images that the looming of distant seacoasts is referable. The coast of France, for instance, seen from that of England across the English channel, the north shore of Lake Ontario seen from Rochester, and even the case of the brig on fire, before referred to. This phase of the mirage is capable of being produced at one and the same time with the true shadow form, though no case of its observation has ever been placed on record; it will, nevertheless, be obvious that the light falling upon the water at A is, after its reflection there, reflected by the glittering sails of the wet ship to B. This act of its interception is also the act of producing a shadow of the ship, which will proceed upward bounded by the dotted lines, E F, of the sixth diagram, which, if intercepted anywhere along the course of its projection, will exhibit also an image of the ship differing from that at B, as a shadow differs from a real image, the shadow being in fact but the absence of the light intercepted by the ship and reflected back to B. To make the causes of the looming of coast lines more clear, we present the seventh diagram, where a section of the curvature of the earth is shown. The rays from the sun, S, being incident upon the surface of the water from A to the base of the building on shore, B, are thence reflected on to the building, which in turn reflects them on to the cloud, C, where the picture thus produced may be viewed from the opposite seacoast at D, just as the images of a magic lantern may be viewed fram the back of a semi-transparent screen on to which they may be projected.

Fig. 5.



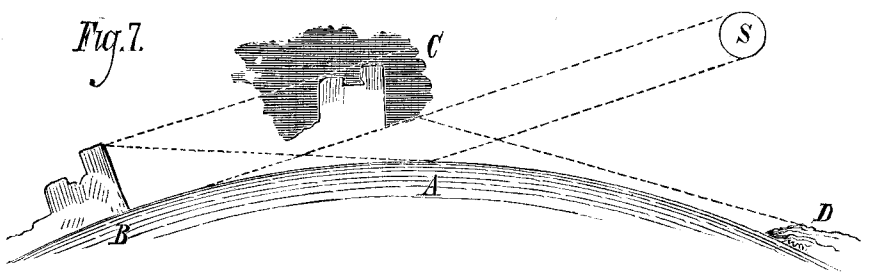
Such images as the specters of the Brocken are merely ordinary shadows, projected from all mountain tops, which are more or less isolated, on to clouds which happen to lie in their paths. Such localities are visited often without seeing the phantoms, because the sun may not be shining at the time of the visit, or there may be no clouds in the proper place to receive the shadows. Those are the true ordinary shadows cast by sunlight, and are transformed into images in the air by the changing angle of an ascending sun, when they occur upon water surfaces and in the presence of proper backgrounds. An example occurred upon the Lake of Geneva, when a vessel and its shadow were visible at the same time. The image, like the vessel, rested with its hull upon the water, the observer incidentally remarking the occurrence took place early in the morning, which, though indefinite, gives us the cue to the fact that the rising sun was a factor in the transaction. As it came over the horizon, it cast the vessel's shadow horizontally along the surface of the lake, until it was intercepted by one of the banks of fog or morning mist, which occur so frequently on all sheets of water. This image disappeared by ascending into the air while moving horizontally in the opposite direction from that to which the vessel's bow was directed. Had the observer suspected that the sun was in any way connected with the phenomena, he would have informed us whether its course corresponded to that of the vessel, which made little or no progress, as the morning was very still; it was, therefore, a case exactly analogous to that before referred to as having been observed on the south coast of England, where the windmill in the one case occupied the place of the vessel in the other, the phenomena in every other respect being the same, except that the shadow of the vessel seemed elongated horizontally, which was occasioned by the fog bank upon which it was projected, having its face obliquely inclined to the line of the shadow's proportion, while the observer occupied a position more nearly at right angles to the face of the cloud, which also accounts for the distorted appearance which those aerial images so often assume.

Fig. 6.



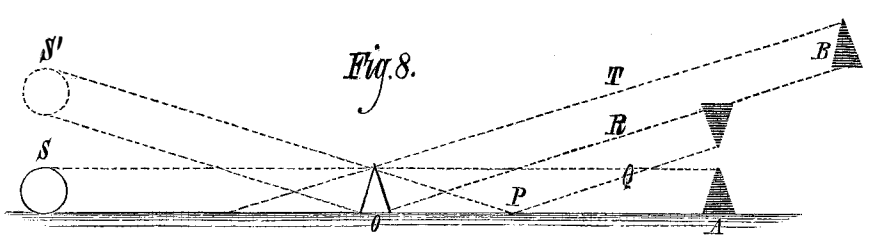
Where objects are situated upon water, the ascending of the sun transfers its shadows to the air, and out of the single horizontal shadow produces two, one erect and one inverted. The manner of changing the ordinary horizontal shadow cast by the light into shadows in the air, may be understood by diagram 8, where S is the sun on the horizon, O the object, and A its shadow. When the sun ascends to S', the shadow of the object is projected on to the water from O to P, and thence reflected into the air bounded by the lines, Q R; but the light also falls upon the water to the sunward side of the object, where, being incident at the same angle, it is reflected at the same angle, casting into the air an erect image of the object, O, bounded by the lines, R T, and screen at B. The increasing altitude of the sun correspondingly increases the angle at which those shadows are reflected from the surface of the water, which correspondingly decreases their chances of encountering clouds, hence, those images are only seen when the altitude of the sun is low. The double images of objects at sea, seen in the air, are therefore nothing more than the outgrowth of a single shadow cast by the sun when on the horizon, unfolding, as the sun rises, two shadows out of one, one of which, being the product of light reflected from the sunward side of the ship, must, of course, be right side up, precisely as if cast by direct sunlight. The other is a true shadow, also cast right side up on to the water on the side of the ship opposite to the sun, but is inverted by the act of reflection after its formation, forming a curious illustration of how a single object illuminated from a single point may cast two shadows perfectly distinct from each other.

Fig. 7.



The mirage of the desert is, however, wholly unassociated with images in the air, as it is merely a case of direct reflection from the surface sands, which being an infinite number of sparkling points lying so closely together as to be optically equivalent to an unbroken reflecting surface, the most elevated portions being more exposed to the luminous conditions of the horizon reflect the most light, and therefore appear as lakes, while the more depressed portions being relatively in shadow relieve the brilliancy by passages comparatively dark, and giving the effect of islands, promontories, etc. Those lakes recede as the traveler advances, seeming constantly to keep their nearest shores about half an hour's march away, because the angle of reflection decreases with distance, and the nearer it approaches to coincidence with the reflecting surface, the greater will be the quantity of light reflected, and, indeed, long before it reaches actual coincidence (that is to say, long before the line of vision rises to the horizon), the angle of total reflection has been passed. In other words, when a line drawn from the eye of the observer to a point upon the plain upon which he is standing makes with that plain an angle of 53°, all beyond that must be of necessity very brilliant, for it is reflecting all the light of the horizon, minus, of course, a little due to inequalities of the land surface.

Fig. 8.



That nature should use her clouds for screens to exhibit her pictures upon is not at all to be wondered at, as they are the only background material she has in the regions where she makes the display, nor is it at all extraordinary or exceptional, for the earliest artificial presentations of aerial figures were made in the same manner and long before the use of the magic lantern was known beyond the cloisters of the mediæval monks, who sometimes exhibited to a carefully selected and exceptional few what they designated the magic circle, accompanying the exhibition with impressive ceremonies and incantations. A circle was described, from the center of which the smoke of burning incense ascended, and upon or in this smoke appeared the demons evoked, writhing and twisting into all imaginable forms through the moving volumes of ascending smoke. Outside the circle were placed the audience, forbidden to cross its boundary under pain of instant destruction by the fiends presented there, who were supposed to be of a peculiarly malignant nature and not always controllable by those who had the power to evoke them. Like other specters of the air, they would at one time appear very distinct, then fade away to invisibility, which depended, of course, upon the changing density of the vapor.

The facts, however, are valuable in this connection, as showing the use of cloud screens for exhibiting images upon, and some of the most clever tricks of modern necromancy are performed in the same manner; no reason, therefore, exists why nature should be incapable of using the same means

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as cleverly as a mountebank, especially as she has such an abundance of ready-made screens always on hand and to spare.

Peculiar Mines in Colorado.

In a recent lecture before the Bullion Club, Professor J. S. Newberry described several new and peculiar mineral deposits which he had been studying in Colorado. In the course of his remarks he said:

I ventured to predict some time ago that Leadville was destined to be as important a gold camp as a silver camp, and my words were verified so far that from eight to ten million dollars of gold were taken out of the California Gulch. Now, the question is, how did the gold come there? Up to the present time it has not been fully traced to its source, and I made up my mind there were discoveries to be made that would surprise people. The development of the "Colorado Prince" is one of these surprises, and I venture to say not the last one.

The gold here is found between a stratum of limestone and porphyry, the limestone being below. The deposits are not in the same form as the bog iron ores, as is generally supposed. They are composed of decomposed iron with iron pyrites, sulphide of iron, sulphide of lead, with more or less of other matters. These ores are mixed in a heterogeneous mass. When they come to be oxidized the iron floats on the top, and as we go lower and lower we find the vein grows richer—in gold and silver principally. This deposit, as I said, is found in a cavity formed between the limestone and porphyry, and my judgment is that that cavity was formed by the action of surface carbonated water that percolated through and made that line of drainage. Then the stream down this line cut out the limestone by solution and left the cavity, which has been filled in by this rubbish, which in due time became oxidized and brought into the condition in which we find it. If we follow it lower down we shall find solid pyrites instead of sulphides. These will contain as much valuable ores, although a different treatment will be necessary in roasting or smelting.

Of the mines of this description the "Highland Chief" is one of the most extraordinary, simply from the magnitude of the deposit. The structure is similar to that of the "Colorado Prince." As to the workings there is a shaft of 88 feet, cutting through the porphyry, and striking the ore body. From this to a depth of 162 feet there is no bottom to the ore. This most extraordinary deposit is a type of these mines which I have been describing. No one knows at present the extent of this fissure, but it seems not improbable that it will be one of the great gold fields of the world. It is certainly, in my opinion, one of the most promising gold fields that has been discovered on this continent. No portion is taken out that will not pay for working it. While I was there thirty tons gave a return of $50.95 per ton. I do not know of any gold mine in the world, with a width of 60 or 80 feet, that will average $50 to the ton. The California mines, from 10 or 12 to 15 feet in width, return about $15 to the ton; in the Black Hills, in gold mines which are really paying, a width of 150 to 175 feet carries $8, $9, and $11 a ton. Now all of us who know anything about mining do not want any property better than that. Where you have a great quantity of quartz containing gold, and cheaply worked—as most of this hard freed rock can be—and find it will stand two tons to the stamp, at $5 per ton, no better profit could be desired. But these mines at Leadville show promise of a much larger profit. I do not mean to say they are better than all other mines, but at present the deposits are found to be entirely beyond parallel. Their value runs from $3,400 to $2 and a fraction per ton. The Silver Cliff, Racine Boy, Bassick, and other mines there are not yet understood, and their geological formation has been misrepresented.

Characteristics of Central Australia.

In the *Victorian Review* for January, Mr. Richard Bennett gives, from personal observation, some account of the little known country lying north of the river Murray, and extending to the great interior called Central Australia, a region which, by the application to it of a comprehensive system of irrigation, might be brought under cultivation, he thinks, and rendered capable of carrying a large population.

The country north of the Murray and Darling rivers, stretching away to Cooper's Creek, is one vast extent of alluvial plains, interspersed with sand ridges, dry lakes, or large depressions surrounded with high banks, and occasional isolated hills, few and far between. A peculiarity of the sand hills or ridges is that they run generally parallel to the large rivers, and between them are flats of very rich black soil, generally covered with myall trees, which yield a transparent gum in large quantities, in all respects resembling gum arabic, perfectly soluble in water, and eaten by the blacks in the neighborhood of the large rivers as an accompaniment to fish and opossum. Mr. Bennett accounts for the parallel formation of the sand ridges, first, by the prevalence of easterly winds sweeping down the valleys between them; next, by the back-water finding a vent over the intermediate flats to the river below during exceptionally high floods.

The sand ridges lying between the Lower Murrumbidgee and Darling are, in many instances, densely covered with spinifex, or, as it is called in those parts, porcupine grass. Nothing eats it, except after the tussocks have been burnt, when sheep are fond of the young green shoots. On the myall flats, between the sand ridges, grasses of the most nutritive description grow, particularly a kind called blue grass, and foxtail, and a great variety of vetches and saltbush; and there are large tracts of depressed plains subject to inundation from floods, formed of rich black plastic soil (like butter in wet weather, and dry and crumbly in summer time), that is covered with wild carrots and a very fine description of wild flax, the bolls of which, especially when the seed is ripe in October, fatten stock rapidly. Sheep graze over the carrot ground when not a vestige of anything green is to be seen on the top, scraping with their forefeet till they get sufficient hold with their teeth on a carrot to pull it out. These carrots have a bitter astringent taste, but are very fattening.

One chief characteristic of this country is the total absence of stone of any description, except in the neighborhood of isolated mountains and hills, some of which are two or three hundred miles apart.

The whole of this flat country, in Mr. Bennett's opinion, has been in ages long past either a vast inland sea, or succession of lakes. With the gradual rise of the continent the waters of these have drained off through the great valleys of the Darling, Murrumbidgee, and other tributaries into the Murray, and have thence been conveyed to the sea. As the drainage went on, large deposits of alluvium were brought down from the mountain ranges in the form of impalpable mud, the drainage of rich up-country river flats and mountain gullies. Some very curious phenomena are occasionally met with. Mr. Bennett has frequently come upon a small plain covered thickly with small nodules of ironstone like peas or buckshot, as if they had rained there, yet outside this particular spot not one was to be found. Again, when riding through the mallee near the Murrumbidgee, his horse sometimes sank up to the girths in a dry white powder like flour, probably some formation of lime. At the Oxley station, on the Lower Lachlan, some forty miles from Balranald, there is a stratum of gypsum in pure crystals, three or four feet in thickness, at a depth of five or six feet from the surface, and the gypsum crops out of the bank of the river.

Throughout these regions no large timber is to be found, except the blue gums, which fringe the large rivers, and which are never found beyond the limit of the river flats. The sand ridges are usually, though not always, covered with pine forests, many trees attaining a height of nearly one hundred feet and a girth of six or seven feet. There is likewise a species of forest oak called belar, which attains a height of fifty to sixty feet with a girth of five or six feet. This timber is exceedingly hard, heavy, dark-grained, and very brittle. This timber grows almost exclusively on red soil, very porous to water, and there are very extensive forests of it. These three species comprise all the large timber. There are forests or flats of yellow box, also of myall or boree; but neither of these attains a size to warrant its being classed as useful timber.

The rest consist of mallee, growing on desolate sandy country, too often covered with spinifex; yarren, which is tall, slender species of myall, forming thick scrubs; mulgu, a poisonous wood growing abundantly about the Darling, Warrego, Parroo, and Bulloo in Queensland; the quandong tree, which grows to the size of an ordinary cherry tree, and bears a red fruit surrounding a yellow indurated stone, in much request for ladies' ornaments, such as buttons, bracelets, etc.; the colane tree, which grows about the Lower Macquarrie and Bogan rivers, the handsomest tree of them all, with a thick foliage of a brilliant bright green, and bears a fruit of dark crimson color, of a very agreeable acid flavor, about the size of a walnut, inclosing a stone very much the size of a nutmeg, and quite solid. The wood of this tree is rather like the English beech, but is very short in the grain, and useless for building or other purposes. There is likewise a tree, called by the blacks yambang, which grows about the Lower Bogan and Macquarrie rivers; it is called by the settlers the native pomegranate, and has a fruit much resembling a Seville orange in size and color when ripe, full of seeds, about the size of small orange pips, embedded in a thick luscious fluid, very agreeable and refreshing when perfectly ripe, but when green, one taste would satisfy the greatest epicure; it is something akin to a compound of turpentine and cayenne pepper, the latter ingredient rather in excess.

There is a smaller species, which is a climbing plant, and grows in the scrub, with a fruit about the size of a pigeon's egg. The taste of this, both in its ripe and unripe state, is almost identical with the large sort; but the rind is very thin, while that of the large sort is thick. Another singular tree is the leopard tree, which grows to a diameter of about a foot. It derives its name from the spotted appearance of its bark, which is studded with scales of the size of a shilling; it bears a pod with a very aromatic scent and flavor. Many aromatic trees and shrubs grow in the scrub, some of which doubtless possess valuable medicinal properties, were they fully investigated.

It was on the Lower Bogan River that Allan Cuningham, the botanist, and a member of Sir Thomas Mitchell's exploring party, was killed by the blacks at a place now known as the "Murdering Stump."

The herbage throughout these extensive districts is mostly saline, consisting of a large variety of saltbush, pigface, cottonbush, portulacca, etc. The absence of large forest timber, stones, and the saline nature of the herbage indicate the comparatively recent formation of this part of Australia. Small conical hills are occasionally met with, one of which in particular, rising out of a plain within a few miles of the Macquarrie marshes, or mole, in a country otherwise totally devoid of stone, is composed of huge granite rocks, and, on riding round it, a hollow vibratory sound is produced, as if large caverns existed. These hills and isolated mountains are, in Mr. Bennett's opinion, the summits of what were once islands, many of them of volcanic origin. Mr. Bennett believes that underneath the whole of this flat country there is an enormous body of fresh water, and that artesian wells will be the cheapest and most efficient means of irrigation.

Archæological Explorations in Missouri.

At a recent meeting of the Boston Society of Natural History, Mr. F. W. Putnam gave some account of the shell heaps of the Atlantic and Pacific coasts of North America, and stated that there had been received at the Peabody Museum a small collection of articles taken from some rude dolmens lately opened by Mr. E. Curtiss, who is now engaged, under his direction, in the work of exploration for the museum. These chambered mounds are situated in the eastern part of Clay county, Missouri, and form a large group on both sides of the Missouri river. The chambers are, in the three opened by Mr. Curtiss, about 8 feet square, and from 4½ to 5 feet high, each chamber having a passageway several feet in length and two in width, leading from the southern side, and opening on the edge of the mound formed by covering the chamber and passageway with earth. The walls of the chambered passages were about 2 feet thick, vertical, and well made of stones, which were evenly laid without clay or mortar of any kind. The top of one of the chambers had a covering of large flat rocks, but the others seem to have been covered over with wood. The chambers were filled with clay which had been burnt, and appeared as if it had fallen from above. The inside walls of the chambers also showed signs of fire. Under the burnt clay, in each chamber, were found the remains of several human skeletons, all of which had been burnt to such an extent as to leave but small fragments of the bones, which were mixed with the ashes and charcoal. Mr. Curtiss thought that in one chamber he found the remains of five skeletons, and in another thirteen. With these remains there were a few flint implements and minute fragments of earthen vessels. A large mound near the chambered ones was also opened, but no chambers were found therein; neither had the bodies been burnt. This mound proved very rich in large flint implements, and also contained well made pottery, and a peculiar "garget" of red stone. The connection of the people who placed the ashes of their dead in stone chambers with those who buried their dead in the earth mounds is, of course, yet to be determined.

Interglacial Quartz Workers in Minnesota.

In 1876 Prof. Winchell found in and around Little Falls, Minnesota, a number of fragments of wrought quartz in surface deposits underneath the remains of the mound builders. Prof. Winchell, accordingly, fixed the era of the quartz workers between that of the mound builders and the close of the glacial epoch.

At a late meeting of the Historical Society, at Minneapolis, Minn., Francis E. Babbit gave an account of a considerable deposit of quartz chips and implements found in regular strata, which must have been formed before the close of the glacial period. The specimens consist of hammers, implements, etc., both finished and unfinished, together with the chips struck off from the articles in the process of manufacture. The material of which they are composed is principally compact, lustrous quartz, frequently mottled as if selected with an eye to the artistic beauty. The stratum is some few inches in thickness, and lies in the soil a few feet below the surface. The appearances indicate that this was once the site of a manufactory of such quartz objects, and this idea is upheld by various considerations. There are tools found such as would be used in the manufacture of quartz articles, and the whole stratum is mixed with chips, which in many cases appear stuck in the dirt just as they fell from the hand of the unknown. Unfinished implements are also found in more or less advanced stages of manufacture. It is not possible to fix the precise point occupied by these remains in the scale of the glacial epoch until the drift features and surrounding formations of the locality shall be better understood than now. Still it is certain that the remains belong to a people living before the end of the last glacial period, because they are deposited in a drift which is known to be of glacial origin. The hard pan upon which the quartz formations lie is probably of the first glacial period, and the quartz may belong to an inter-glacial epoch.

Beet Sugar in Maine.

The past year's work of the Maine Beet Sugar Company at Portland was not bad for a beginning. In a report to the 1,700 farmers who raised the beets the company say that the average crop from 100 acres was 9½ tons; in some cases the return was not enough to pay cost of seed and fertilizers; the other extreme was 30 tons per acre. For 9,000 tons delivered at the factory, $56,000 were paid; for storing and pitting, $6,000; fuel, $10,000; labor and other expenses, $37,000; total, $107,000. The product, 900 tons of sugar and molassess, brought $110,000, leaving $3,000 toward machinery and fixtures that cost $60,000, to which must be added the State bounty. The company wish to continue the experiment, and invite the growers to renew their contract for at least one acre each. They say, however, that they cannot afford to increase the price per ton, except for early deliveries, which can be worked up before freezing weather, and thus save expense of pitting.

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Business and Personal.

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I am much pleased with the Paint, and wish now to try the pure white for inside work, etc. Yours truly,

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Wanted—The address of the manufacturers of Union Spring Churn, G. W. Collins, Patentee. F. A. Griffin, Clyde, Kansas.

We are frequently asked, "Which is the largest, best, and most reliable retail clothing house in New York?" To one and all we say, Baldwin the Clothier's.

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Machines for Tapping Water Mains under Pressure. Apply at Easton Brass Works, Easton, Pa.

For Sale.—Four Boilers, 100 horse power each, return drop flue; A 1 condition; $1,500 each. 1 Berryman Heater, 42 x 96; A 1 condition: $400. D. L. Einstein, 16 White St., New York.

Traction Tire for Portable Engines, etc. Sole manufacturers, H. Lloyd, Son & Co., Pittsburg, Pa.

Peck's Patent Drop Press. See adv., page 173.

Spokes and Rims, white oak and hickory, best quality, to any pattern, and Hammer Handles of best hickory. John Fitz, Martinsburg, West Va.

For the best Stave, Barrel, Keg, and Hogshead Machinery, address H. A. Crossley, Cleveland, Ohio.

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Stave, Barrel, Keg, and Hogshead Machinery a specialty, by E. & B. Holmes, Buffalo, N. Y.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

Sheet Metal Presses, Ferracute Co., Bridgeton, N. J.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, importers Vienna lime, crocus, etc. Condit, Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty St., New York.

Wright's Patent Steam Engine, with automatic cut-off. The best engine made. For prices, address William Wright, Manufacturer, Newburgh, N. Y.

Presses, Dies, and Tools for working Sheet Metal, etc. Fruit & other can tools. Bliss & Williams, B'klyn, N. Y.

Bradley's cushioned helve hammers. See illus. ad. p. 205.

Forsaith & Co., Manchester, N. H., & 213 Centre St., N. Y. Bolt Forging Machines, Power Hammers, Comb'd Hand Fire Eng. & Hose Carriages, New & 2d hand Machinery. Send stamp for illus. cat. State just what you want.

Electrical Indicators for giving signal notice of extremes of pressure or temperature. Costs only $20. Attached to any instrument. T. Shaw, 915 Ridge Ave. Phila.

Instruction in Steam and Mechanical Engineering. A thorough practical education, and a desirable situation as soon as competent, can be obtained at the National Institute of Steam Engineering, Bridgeport, Conn. For particulars, send for pamphlet.

Hydraulic Jacks, Presses and Pumps. Polishing and Buffing Machinery. Patent Punches, Shears, etc. E. Lyon & Co., 470 Grand St., New York.

Portable Forges, $12. Roberts, 107 Liberty St., N. Y.

Telephones repaired, parts of same for sale. Send stamp for circulars. P. O. Box 205, Jersey City, N. J.

For Pat. Safety Elevators, Hoisting Engines, Friction Clutch Pulleys, Cut-off Coupling, see Frisbie's ad. p. 188.

Machine Knives for Wood-working Machinery, Book Binders, and Paper Mills. Large knife work a specialty. Also manufacturers of Soloman's Parallel Vise. Taylor, Stiles & Co., Riegelsville, N. J.

Special Wood-Working Machinery of every variety. Levi Houston, Montgomery, Pa. See ad. page 173.

For Mill Mach'y & Mill Furnishing, see illus. adv. p. 188.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 189.

Portable Railroads. Sugar Mills. Horizontal & Beam Steam Engines. Atlantic Steam Engine W'ks, B'klyn, N.Y.

Planing and Matching Machines, Band and Scroll Saws, Universal Wood-workers, Universal Hand Jointers, Shaping, Sand-papering Machines, etc., manuf'd by Bentel, Margedant & Co., Hamilton, Ohio. "Illustrated History of Progress made in Wood-working Machinery," sent free.

Fire Brick, Tile, and Clay Retorts, all shapes. Borgner & O'Brien M'f'rs, 23d St., above Race, Phila., Pa.

The Chester Steel Castings Co., office 407 Library St., Philadelphia, Pa., can prove by 15,000 Crank Shafts, and 10,000 Gear Wheels, now in use, the superiority of their Castings over all others. Circular and price list free.

Brass & Copper in sheets, wire & blanks. See ad. p. 205.

Millstone Dressing Diamonds. Simple, effective, and durable. J. Dickinson, 64 Nassau St., New York.

Walrus Leather, Solid Walrus Wheels; Wood Wheels covered with walrus leather. Greene, Tweed & Co., N.Y.

The Improved Hydraulic Jacks, Punches, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

For Superior Steam Heat. Appar., see adv., page 204.

We will purchase or manufacture on royalty, patented articles of real merit. Farley & Richards, Phila., Pa.

Silent Injector, Blower, and Exhauster. See adv. p. 205.

Millstone Dressing Machine. See adv., page 206.

Cut Gears for Models, etc. Models, working machinery, experimental work, manufacturing, etc., to order. D. Gilbert & Son, 212 Chester St., Phila., Pa.

Linen Hose and Rubber Hose of all sizes, with or without coupling. Greene, Tweed & Co., New York.

Holly System of Water Supply and Fire Protection for Cities and Villages. See advertisement in SCIENTIFIC AMERICAN of last week.

The E. Horton & Son Co., Windsor Locks, Conn., manufacture the Sweetland Improved Horton Chuck.

The best Truss ever used. Send for descriptive circular to N. Y. Elastic Truss Co., 683 Broadway, New York.

Inventors' Institute, Cooper Union. A permanent exhibition of inventions. Prospectus on application. 733 Broadway, N. Y.

For Reliable Emery Wheels and Machines, address The Lehigh Valley Emery Wheel Co., Weissport, Pa.

Steam Engines; Eclipse Safety Sectional Boiler. Lambertville Iron Works, Lambertville, N. J. See ad. p. 17

Hydraulic Cylinders, Wheels, and Pinions, Machinery Castings; all kinds; strong and durable; and easily worked. Tensile strength not less than 65,000 lbs. to square in. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

New Economizer Portable Engine. See illus. adv. p. 206.

Fine Taps and Dies in Cases for Jewelers, Dentists, and Machinists. Pratt & Whitney Co., Hartford, Conn.

Catechism of the Locomotive, 625 pages, 250 engravings. The most accurate, complete, and easily understood book on the Locomotive. Price $2.50. Send for a catalogue of railroad books. The Railroad Gazette, 73 Broadway, New York.

For Shafts, Pulleys, or Hangers, call and see stock kept at 79 Liberty St., N. Y. Wm. Sellers & Co.

Wm. Sellers & Co., Phila., have introduced a new injector, worked by a single motion of a lever.

Ore Breaker, Crusher, and Pulverizer. Smaller sizes run by horse power. See p. 204. Totten & Co., Pittsburg.

For Patent Shapers and Planers, see ills. adv. p. 188.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

W. B. M.—1. Argillaceous lime carbonate. 2. Calcite. 3. Celestite, contains about 50 per cent of strontia. 4. Fluorspar in quartz. 5. Hematite.—P. H. S.—An impure kaolin; it would hardly pay to work.—F. B. Mc.—It is magnetic iron sand mixed with menacconite, or titaniferous iron and quartz sand; no chromium present.—C. M.—It is a fine silicious clay, it might be useful for some polishing purposes and in the manufacture of certain kinds of pottery, but it would hardly bear transportation East.—T. S. S.—It is an argillo-silicious lime carbonate, possibly a good cement stone. It might repay an analysis.—J. B. C.—It is quartz.

COMMUNICATIONS RECEIVED.

On Sun Spots. By A. E. H.
On Uniformity of Gauge. By J. R.
On a New Ellipsograph. By D. N. G.
On Filing. By R. G.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

March 2, 1880,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, or any patent issued since 1867, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

Air compressor, J. H. Parkinson 225,161
Air cooling apparatus, W. S. Wilkinson 225,192
Animal trap, W. S. Kisinger 225,144
Annunciator, electro-magnetic, A. Bosch 225,099
Axle box, car, C. Barrett 224,986
Axle box, car, Crockett & Barrett 224,997
Axle box, vehicle, J. W. Trueblood 225,184
Axles, ball and socket coupling for vehicle, J. Sinnamon 225,027
Balance wheel connecting device, B. Merritt 225,068
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Berth, pendulum, F. Gardner 225,006
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Boiler furnace, W. M. Fisher 225,051
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Boot, plowman's, S. Brown 225,103
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Hoe and rake, I. A. Murchison 225,157
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Hoop machine, barrel, G. A. Raupp 225,075
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Hot air register, S. Tuttle, Jr. 225,085
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Yarn, apparatus for detecting knots in, R. Alioth 225,039
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Carpet, W. J. Gadsby 11,662, 11,663
Carpet, T. J. Stearns 11,666
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Engine governors, N. E. Nash, Westerly, R. I.
Explosives, J. Pattison, Nevada City, Cal.
Furnace for boilers, F. W. Brainerd, Freeport, Ill.
Galvanic battery, H. E. Hunter, Hinsdale, N. H.
Knife polishing machine, W. S. Guinness, N. Y. city.
Pens, fountain, A. M. Sutherland *et al.*, Brooklyn, N. Y.
Pumps, G. H. Felt, New York city.
Rolling machine, G. Parr, Buffalo, N. Y.
Shearing textile fabrics, apparatus for, D. C. Summer *et al.*, Millbury, Mass.
Sugar moulding apparatus, C. H. Hersey *et al.*, Boston, Mass.
Stave machine, E. & B. Holmes, Buffalo, N. Y.

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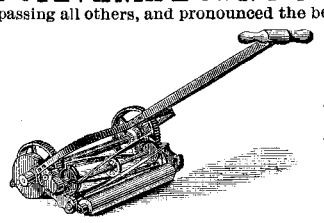
1880  1880

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	Cuts grass more smoothly.
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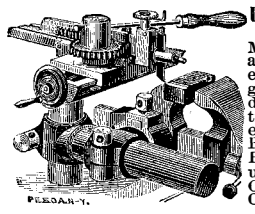

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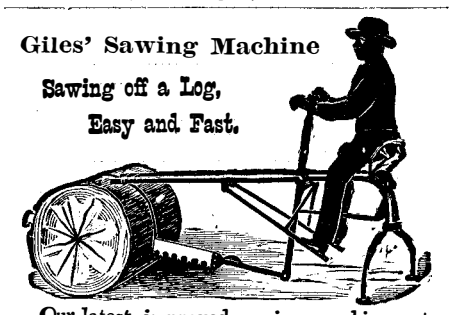
Sawing off a Log,
Easy and Fast.



Our latest improved sawing machine cuts off a 2-foot log in 2 minutes. A **$100 PRESENT** will be given to two men who can saw as much in the old way, as one man can with this machine. Circulars sent free.
United States Manufacturing Co., Chicago, Ill.
CAUTION.—We are the first inventors, and own 17 different saw machine patents. Any sawing machine having a seat for the operator, or treadles for his feet, is an infringement on our patents, and we are prosecuting all infringers. SO BEWARE OF WHOM YOU BUY.

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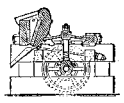

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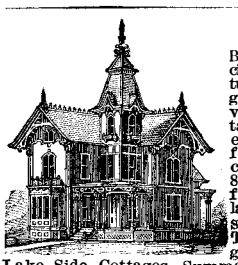

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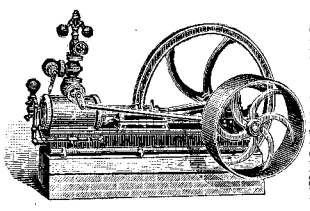

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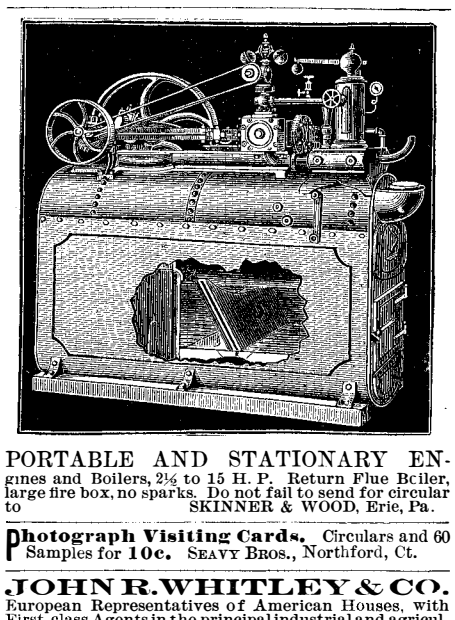

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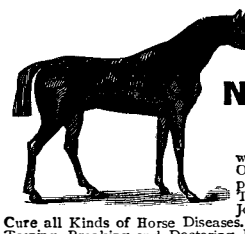

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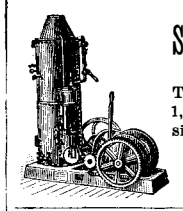

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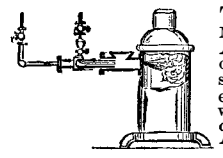

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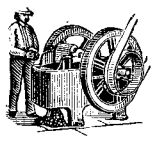

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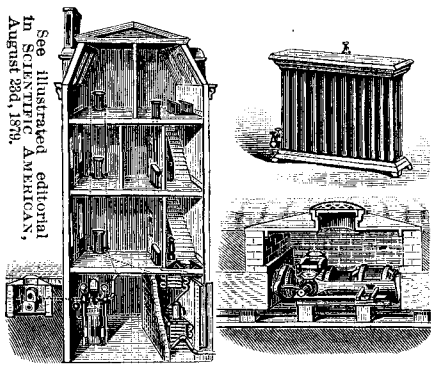

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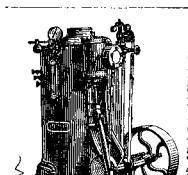

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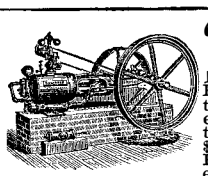

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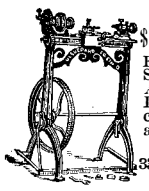

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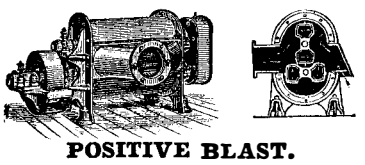

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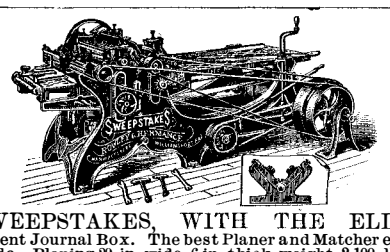

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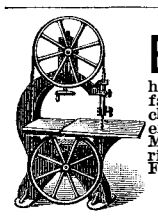

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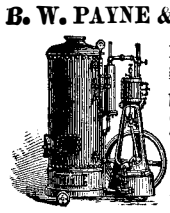

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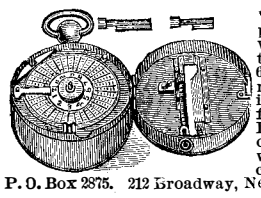

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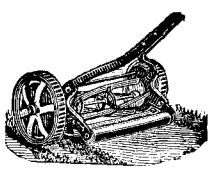

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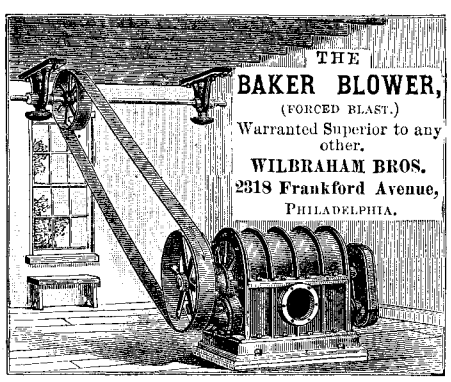

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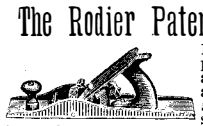

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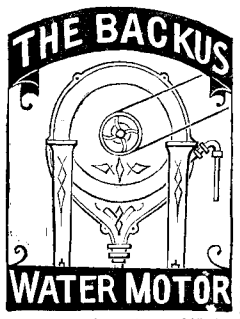

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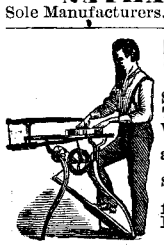

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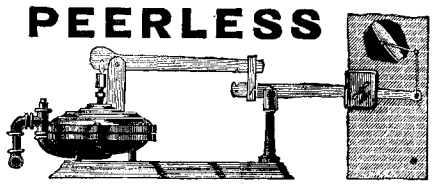

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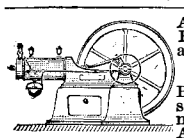

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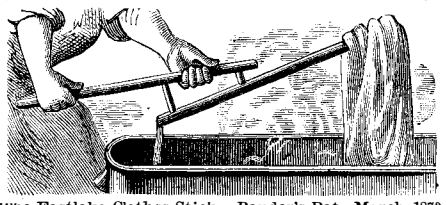

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